THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XXI JUNE, 1929 No. 6

RADIUM TREATMENT OF CARCINOMA OF THE CERVIX DURING 1927*

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DURING the year 1927, 214 cases of carcinoma of the cervix were observed in the Section on Radium Therapy at The Mayo Clinic. From the standpoint of comparison, the work of the year may be considered representative; very few, if any, new features have had to be considered.

In more than 20 per cent of the cases the disease occurred before the age of the menopause and in more than 50 per cent it occurred after the age of the menopause; thus in less than 30 per cent the disease occurred during the age of the menopause (Table 1).

TABLE I
AGE INCIDENCE

Age	Cases	Per Cent
20–29	6	2.80
30–39	37	17.28
40–49	63	29.43
50–59	83	38.78
60–69	22	10.28
70–79	2	0.93
80–89	1	0.46
Total	214	

Average age, 48.58 years.

All cases that were observed for the first time were classified as new cases (Table II). The classification is based on the degree of local involvement. In the "early" group, the pathological changes should be limited to the canal portion of the cervix; as a rule, palpation and inspection are not sufficient for the diagnosis. The removal of tissue with the curette is necessary. When the disease involved the vaginal face of the cervix, palpation and inspection were positive for carcinoma and they were grouped as "borderline."

TABLE II
NEW CASES

Group	Total		Treated		Untreated*	
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
Early	1	0.67	1	100.00	..	.....
Borderline	4	2.68	3	75.00	1	25.00
Inoperable	95	63.75	91	95.78	4	4.21
Recurring	1	0.67	1	100.00	..	.....
Modified	48	32.21	37	77.08	11	22.91
Total	149	.....	133	89.26	16	10.73

* Disease too advanced for treatment	8	(modified 5 inoperable 3)
Treatment being applied elsewhere	4	(modified 3 inoperable 1)
Local activity not determined	3	(modified 2 borderline 1)
Recent treatment elsewhere	1	(modified 1)
Total	6	

* Read at the Thirteenth Annual Meeting, AMERICAN RADIUM SOCIETY, Minneapolis, Minn., June 11–12, 1928.

All cases in which the disease had extended to the vaginal walls or infiltrated the broad ligaments, with or without fixation, were classified as "inoperable."

The cases belonging to the "recurring" group are those in which adequate surgical procedures or irradiation were employed for a supposedly early or borderline lesion. In the modified group were placed all cases in which some type of apparently inadequate procedure had been employed for a supposedly inoperable condition. From the standpoint of irradiation, it is necessary to keep this group of cases separated from the inoperable and recurring cases, chiefly because they do not lend themselves well to adequate treatment or what may be considered subsequent treatment. It is obvious that the most opportune time to treat a lesion adequately is at the time the patient is first seen and not six or more weeks afterward. One of the most important factors for defeat in inadequate treatment is the presence of two distinct fields, one in which the tumor cells have been sufficiently irradiated, the second field containing actively growing, malignant cells capable of local extension and metastasis occurring during the interval allowed. This is surely a highly undesirable state of affairs from the standpoint of an efficient therapeutic measure.

There was a total of 149 cases in which examination was carried out for the first time and of these about 3 per cent might be considered in the favorable group, while over 96 per cent were in the groups in which only palliation could be expected. Still, it is astonishing to what an extent this will occur in some cases so it is grossly evident that every case is worthy of our best consideration at the time the first examination is made. Ninety-five per cent of the inoperable group of cases and 77 per cent of the modified group were considered favorable. For treatment these are rather high percentages when the extent of the disease and the degree to which the health of the patients has been undermined is taken into account, showing rather clearly the flexibility of the treatment factors employed to meet the problems each case presents. Treatment was not given in 16 cases (Table II). In only 8 of the cases was the disease too advanced for treatment. In a few of the modified cases, it was almost impossible to be certain whether or not activity was present. Healing is incomplete, and in case of doubt observation rather than treatment is usually recommended.

In the second classification were old cases (Table III) in which treatment had

TABLE III
OLD CASES

Group	Total		Treated		Untreated*	
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
Borderline	6	9.23	.....	.....	6	100.00
Inoperable	39	60.00	7	17.94	32	82.05
Modified	20	30.76	5	25.00	15	75.00
Total	65	.....	12	18.46	53	81.53

* Local activity not determined	49	borderline	6
		inoperable	32
		modified	11
Disease too advanced for treatment	3	(modified	3)
Treatment being applied elsewhere	1	(modified	1)
Total	53		

been given sometime in the past; in the main, the group comprised those patients who returned for reëxamination. It is encouraging to note that 49 of the 65 cases revealed complete healing of the primary lesion; that is, activity could not be demonstrated. In 3 instances in which the disease was too advanced for further treatment the cases were in the modified group. As a rule, the primary treatment is decidedly effective and therefore never repeated. In 12 cases, treatment was again applied; of these, 7 were in the inoperable group, and 5 in the modified group. The subsequent treatment, when necessary, is usually directed to small active carcinomatous areas outside of the primary treatment field.

The diagnosis of carcinoma of the cervix uteri can now be made from the history, by palpation, and by inspection of the diseased area. Early cases offer some difficulties in that it is necessary to remove tissue with the curette to confirm the clinical impression. In order to advance our knowledge of the disease, biopsy was performed in 85.99 per cent of the cases (Table IV). The remaining cases were obviously malignant; on account of the presence of hemorrhage

Table IV
MICROSCOPIC EXAMINATION

Microscopic Diagnosis	Total		Early		Borderline		Inoperable		Recurring		Modified	
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
Epithelioma, not graded	17	9.23	1	100.0	3	30.0	8	6.40	1	100.0	4	8.51
Squamous cell epithelioma, graded 2	20	10.86	..	.....	1	10.0	14	11.20	..	.....	5	10.63
Squamous cell epithelioma, graded 3	65	35.32	..	.....	3	30.0	47	37.60	..	.....	15	31.91
Squamous cell epithelioma, graded 4	59	32.06	..	.....	2	20.0	40	32.00	..	.....	17	36.17
Adenocarcinoma, not graded*	2	1.08	..	.....	..	....	1	0.80	..	.....	1	2.12
Adenocarcinoma, graded 2	6	3.26	..	.....	..	....	3	2.40	..	.....	3	6.38
Adenocarcinoma, graded 3	7	3.80	..	.....	1	10.0	6	4.80				
Adenocarcinoma, graded 4	2	1.08	..	.....	..	.....	2	1.60				
Inflammatory	6	3.26	..	.....	..	....	4	3.20	..	.....	2	4.25
Total (with biopsy)	184	85.98	1	.....	10	....	125	.....	1	.....	47	
(without biopsy)	30	14.01	..	.....	..	....	9	6.71	..	.....	21	30.88
Grand total	214	.....	1	.....	10	....	134	.....	1	.....	68	

* One pathologic report was "epithelioma and carcinoma found;" arbitrarily it was classed as adenocarcinoma.

or marked necrosis, however, it was not deemed advisable to remove a section for study. Nine of the cases were in the inoperable group and 21 in the modified group. In the latter group, the incomplete procedures employed caused, as it were, superficial healing, and in many of the cases the vaginal mucous membrane was intact. It does not seem good judgment to incise the tumor in order to remove tissue for study. In many instances, tissue previously removed was available. Small sections removed from a representative area give a rather high percentage of positive reports. Of a total of 184 sections taken, only 6 were reported inflammatory; that is, 96.74 per cent were reported malignant. The removal of a second, or repeated, section would increase this percentage. Squamous cell lesions predominate, since 87.47 per cent were reported, and adenocarcinoma was found in 9.22 per cent of the cases. Table IV shows rather clearly that the operability was not dependent on the type of lesion encountered in that the borderline, operable, and modified groups show that carcinoma, graded 2, was encountered in 10 per cent, 11.20 per cent, and 10.63 per cent, respectively; carcinoma, graded 3, was encountered in 30 per cent, 37.60 per cent, and 31.91 per cent, respectively, and carcinoma, graded 4, was encountered in 20 per cent, 32 per cent, and 36.17 per cent, respectively. The adenocarcinomas are too few to be of value for comparison. The lesions were definitely characteristic and therefore there is very little chance for confusion.

The new and old cases in which radium and combined radium and roentgen-ray treatment was carried out are grouped in Table V. We apply, whenever possible, the combination treatment; the radium applications precede the roentgen treatments. The radium treatments may be considered under four headings: (1) complete, (2) limited, (3) abandoned and (4) prophylactic. From the standpoint of efficient radium treatment, it is of prime importance to maintain a simple classification. We feel confident that only by such a method can radiotherapeutic judgment be advanced or maintained. At the time the patient is first seen, the treatment is outlined and if treatment is applied it is classified as complete. In a few instances, on account of the massive local involvement, or a break in the general health, only limited treatment is outlined and applied. At times, on account of various complications, the treatment may be abandoned. Every endeavor should be made to keep the number of patients in the latter group as small as possible. Prophylactic applications are made in cases in which operation is performed and

TABLE V

CLASSIFICATION OF IRRADIATION APPLIED TO TREATED CASES

New Cases	Radium Treatment														
	Complete						Limited				Abandoned		Prophylactic		
	Cases	Courses of Roentgen Ray				Cases	Courses of Roentgen Ray				Cases	Courses of Roentgen Ray	Cases	Courses of Roentgen Ray	
		0	1	2	3		0	1	2	3		0		0	1
Early	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
Borderline	2	..	1	1	..	..	..	..	..	..	..	..	1	1	
Inoperable	69	5	42	22	3	16	6	8	2	..	6	6			
Recurring	1	..	..	1*											
Modified	8	..	5	3	..	28	9	10	7	2	..	..	1	..	1
Total	80	5	48	27	3	44	15	18	9	2	6	6	3	1	2
Old cases															
Inoperable	5	1	1*	3*	..	2	..	..	1*	1*					
Modified	1	..	..	1*	..	4	1	..	3*						
Total	6	1	1	4	..	6	1	..	4	1					
Grand total	86	6	49	31	3	50	16	18	13	3	6	6	3	1	2

* One or more courses of roentgen-ray treatment previous to 1927.

the surgeon is certain that all visible and palpable diseased tissue has been thoroughly removed.

In 80 of the 133 new cases complete treatment was given, and in 44 limited treatment was given. In 6 cases the treatments were abandoned and in 3 prophylactic radium treatment was given. It was unfortunate that in 16 of the 69 inoperable cases only limited treatment could be given; in 6 of these the treatment was abandoned usually on account of some complication. In the 37 cases in the modified group efficient treatment was given in only 8.

We believe that substantial proof of the efficiency of the broken-dose method of radium application is definitely shown in the review of the old cases. Sixty-five cases were studied and of these, 49 (75.94 per cent) did not show activity in the original treatment field. In only 3 cases was the condition too advanced for further treatment and these were in the modified group (Table III). Further, of the 145 cases accepted for treatment, only 12 were classified as old cases. In 6 of these complete treatment was given and in 6 the treatment was limited.

The broken-dose method has been employed at The Mayo Clinic as a routine; modifications, however, have been made from time to time. Ten representative cases from each treatment group were selected for analysis (Table VI). The radium applicator is the universal tube containing 50 mg. of radium sulphate (element), filtered through the wall of the applicator (1.5 mm. of monel metal), or about 50 millicuries of radon filtered through the wall of the applicator (0.5 mm. of silver) and 1.0 mm. of brass; both are usually designated as cervical applicators.

When treatment is applied in the crater, 2.0 mm. of lead is added. At times 2.0 mm. of Para rubber is added to the lead filter. The vaginal applicator is made up with the radium salt, or radon containers, filtered through their respective walls and 2.0 mm. of lead and 1.0 cm. of Para rubber. Three areas are usually treated, the time of application varying from ten to fourteen hours for each area. The areas are designated as follows: (1) vaginal cul-de-sac, (2) right vaginal fornix, and (3) left vaginal fornix. The vaginal treatments are applied as the final radium applications.

In some of the bulky, medullary, cervical growths, the cervical applicator is buried centrally into the mass for a standard treatment time of fourteen hours. From one to three applications may be necessary for a satisfactory reduction in the size of the tumor. In selected cases, needles containing 5 or 10 mg. of radium sulphate (element) are buried in the cervical tumor about 1 cm.

TABLE VI

TREATMENT FACTORS, AVERAGE APPLICATIONS TO TEN CASES IN EACH GROUP

Treatment	Total			Cervical			Intrauterine			Vaginal		
	Average Number	Average Mg.-hr. Each†	Average Mg.-hr. Total	Average Number	Average Mg.-hr. Each	Average Mg.-hr. Total	Average Number	Average Mg.-hr. Each	Average Mg.-hr. Total	Average Number	Average Mg.-hr. Each	Average Mg.-hr. Total
Complete	7.9	654	5169	4.0	526	2105	1.1	1160	1276	2.8	603	1690
Limited	2.9	517	1799	1.2	539	647	0.2	1005	201	1.5	593	890
Prophylactic*	2.6	350	1550	0.3	606	200	...	...	...	2.3	673	1350
Abandoned*	3.5	672	2258	2.5	609	1524	0.3	900	300	0.6	656	433

* Six cases only.
† Or millicurie-hours.

apart, delivering from 700 to 1400 milligram-hours in one application; this is very efficient in bringing about reduction without ulceration or necrosis. As soon as the cervical canal can be identified, this portion of the uterus is divided into two fields, designated as anterior and middle, their length being about 2.5 cm. Two applications are usually made at each level.

In the intrauterine applications, tandem applicators are employed, generally with radon tubes of 50 mc. each, filtered as are the cervical applicators. One application is the rule; in the deep uterine cavities, however, application to two areas may be given. About two treatments a week are applied, thus permitting an interval of three to four days occasionally; especially following the buried needle technique, an interval of seven days may be a distinct advantage owing to the probable rapid reduction which usually occurs. The vaginal applications are made daily until finished. Table VI shows the average milligram-hours or millicurie-hours for different types of applicators. The cautious or low dose, which may be 400 to 500 mg-hr., is not shown; the upper limit may be 700 to 1400 mg-hr. A few cases have received more in one application.

All patients are hospitalized for twenty-four to forty-eight hours. The preparation is simple. The hairy parts about the external genitalia are shaved and a sterile warm water vaginal douche is given. During the stay in the hospital the patients are on a basic diet. Half an hour preceding treatment by the buried needle technique or the intrauterine application, one No. 2 H.M.C. tablet is given hypodermically.

TABLE VII

COMPLICATIONS DURING AND IMMEDIATELY AFTER TREATMENT

Complication	Inoperable	Modified	Total
Pelvic cellulitis	2	1	3
Hemorrhage	1	..	1
Pelvic abscess	1	..	1
Pyometritis	1	..	1
Pyometritis and pelvic peritonitis	1	..	1
Retroperitoneal abscess	1	..	1
Total	7	1	8

The complications, shown in Table VII, were sufficient to warrant a longer interval between treatments, and in some cases even abandonment; in 3 cases complications were the cause of death. There were other complications, for example, hemorrhage, which did not prove serious. Many patients were admitted on account of severe vaginal bleeding which responded to ordinary measures.

Pyometritis is associated with a malignant process in many cases; it does not require any special therapeutic management, however, and as the tumor responds to treatment this dangerous feature also subsides. The inoperable group gives the radiotherapist his chief concern. The patients in this group form the majority of the patients seen. In many instances, the complication can be anticipated and as soon as early manifestations make themselves known, treatment is stopped and measures are instituted to combat the impending complication. Pelvic cellulitis may resolve or progress to pelvic abscess, pelvic peritonitis, and probable retroperitoneal abscess. It may now be considered a

TABLE VIII

IMMEDIATE RESULTS IN TREATED CASES CLASSIFIED BY TYPE OF CASE

	Improved		Unimproved		Indeterminate		Deaths		
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Total
Total	178	89.89	2	1.01	15	7.57	3	1.51	198
Early	1	100.00	..	.....	..	.....	..	.....	1
Borderline	9	100.00	..	.....	..	.....	..	.....	9
Inoperable	115	88.46	1	0.76	12	9.23	2	1.53	130
Recurring	...	.....	1	100.00	...	.....	...	.....	1
Modified	53	92.98	...	.....	3	5.26	1	1.76	57

major complication; therefore, every endeavor should be made to make an early diagnosis and then institute immediate treatment.

Hemorrhage, due to surface bleeding of medullary tumors, usually responds with packing and the application of 50 per cent silver nitrate solution. One or more applications of radium cause surface healing, and then this complication usually passes away. The bleeding from malignant craters gives us most concern, since ordinary measures usually give but mediocre results or fail entirely. The larger blood vessels, such as the vaginal branches of the uterine artery, are involved.

Immediate results were the chief concern in this study. About 90 per cent of the patients were improved; clinical impression substantiates this. Most of the patients were definitely improved. Pain, vaginal discharge, and odor were usually modified or stopped entirely, by only a few applications of radium. Table VIII shows clearly that patients of the modified group can be further improved when the proper treatment factors are selected. About 93 per cent were definitely benefited. In this brief study it is not possible to furnish a cross section which would give an adequate picture of the wretched state most of these cases were in when they applied for treatment. Of a total of 214 patients the disease was believed to be too far advanced for treatment in only 11.

Table IX was arranged to answer the question of whether or not there is any difference in the response of the different types of malignant tumors treated. There were enough squamous cell epitheliomas to warrant the statement that they respond equally well; however, it seems true also that each grade has certain characteristics which make the selection of proper treatment factors important. As yet, it is not possible to make definite recommendations. The best results are obtained when it is possible to have at hand various types of radium applicators to select from, since it is of paramount importance to apply individual treatment rather than standard treatment.

The treatment carries with it certain risks. The mortality was 1.51 per cent (Table VIII). It is impossible to place the

TABLE IX

IMMEDIATE RESULTS IN TREATED CASES, CLASSIFIED BY GRADE OF MALIGNANCY

Microscopic Diagnosis	Total	Improved		Unimproved		Indeterminate		Died*	
	Cases	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
Squamous cell epithelioma, not graded	17	14	82.35	1	5.88	1	5.88	1	5.88
Squamous cell epithelioma, graded 2	20	19	95.00	..	....	1	5.00		
Squamous cell epithelioma, graded 3	65	58	89.23	1	1.53	5	7.69	1	1.53
Squamous cell epithelioma, graded 4	58	53	91.37	..	....	4	6.89	1	1.72
Adenocarcinoma, not graded	2	2	100.00						
Adenocarcinoma, graded 2	6	6	100.00						
Adenocarcinoma, graded 3	7	6	85.71	..	....	1	14.28		
Adenocarcinoma, graded 4	2	1	50.00	..	....	1	50.00		
Inflammatory	6	5	83.33	..	....	1	16.66		
Total (with biopsy)	183	164	89.61	2	1.09	14	7.65	3	1.63
(Without biopsy)	15	14	.....	..	....	1			
Total	198	178	.....	2	....	15	.....	3	

* Causes of death:
Streptococcus septicemia 1 (inoperable new case).
Multiple abscesses liver 1 (inoperable new case).
Hemorrhage uterine artery (vaginal branch) 1 (modified new case).

proper interpretation on the causes of death, especially when an attempt is made to evaluate the part of the radiation treatment in the mortality rate. The risk is in the inoperable and modified groups. There is a possibility that the mechanical manipulations necessary in removing a small section for study and the radium applications may disseminate the infectious process, producing the streptococcus septicemia and the multiple abscesses of the liver. However, when one considers the hundreds of biopsies, and the thousands of applications that have been made, the risk seems almost nil. Every precaution is taken to reduce the necessary manipulations. In the case of hemorrhage there was healing in the treatment field, and gross evidence of malignancy could not be demonstrated. The bleeding occurred at the base of what might be termed a healing ulcer. It was superficial and free of sloughing material; in other words, it was an apparently clean ulcer.

SUMMARY

The year 1927 was a representative period. A review of this sort emphasizes the immediate results and complications noted during the year. Since palliation is all that can be expected in the majority of cases, it is possible to lose sight of this important feature of the treatment in the studies of three-year and five-year figures. Further it is clearly demonstrated that the primary lesion will respond to adequate treatment. Radium is decidedly efficient in the treatment of early and borderline lesions and it is astonishing to what an extent palliation will occur following the proper treatment of the lesions of the other groups.

The broken-dose method applied during what may be termed a brief treatment period offers definite advantages, especially since individual treatment is of prime importance for good results. Furthermore, the malignant process has certain potentialities for producing complications and these can be properly interpreted rather than charging them to the usual so-called radium reaction. In our experience, there is a definite systemic effect which can be attributed to the therapeutic rays. It has characteristic symptoms which are readily recognized and, as a rule, seldom confused with other impending complications, and permits the immediate institution of recognized methods of treatment.

Early recognition of the disease, and immediate proper care of the patient should greatly enhance the results now obtained.

ABSTRACT OF DISCUSSION

Dr. Henry Schmitz, Chicago. I recently went over 239 of our cases, and of those we knew the end-results in 100. It was interesting to note that in the most favorable group from the histological standpoint there were 19, in the next 14, in the next 34, and in the next 31. In the clinical grouping we use the same classification as Dr. Bowing. The same observation has been made in our cases which we surveyed recently. We had 470 cases in which we knew the end-result. In these, in Groups I and II, I think only about 17 per cent were well; in the other groups, probably about the same number. The inoperable groups consituted the largest number in this survey. I do not know the exact percentage, but it surpasses the average groups.

As to the result of radiotherapy, the five-year end-result with no signs of carcinoma remaining amounts to a little more than 70 per cent in Group I. This percentage dropped down to 40 per cent in the borderline cases, while in the other group it is only about 12 per cent.

Another interesting observation which we made was that we could classify the cases into three periods, depending upon the improvement in the technique of roentgen therapy. At the end of 1921 we used the moderately full method, with a kilovoltage of 110. The filter was about 4 to 6 mm. aluminum, the distance about 32 cm. and the fields about 5 cm. square. Depending upon the size of the patient they were given varying numbers of fields. This had little influence on the carcinoma, so whatever results we had were due to the radium. The use of radium has remained the same in our clinic; we have never changed it. The application is an interrupted one, in that we use ten to eight day intervals, one application of thirty hours, so that within a few hours the entire radium treatment is finished. We have one class in which the radium is inserted and left in for forty-eight hours without removal. We could not keep these patients in the hospital. The same was done with the roentgen ray, so that the entire treatment would be finished within a week. We stopped this because the reaction of

the patient was so severe that we had to do something to overcome it. The patients would go home and be practically invalided from four to six weeks, in some instances. Since we have returned to our interval application, by which the radium and roentgen rays are given at stated intervals, the results have been different and we have increased the dose by 33 per cent.

In the second period we used 140 kv., with aluminum or copper screening. The calculations with the dose given at the cervix are usually from 95 to 110 per cent, varying upon the anteroposterior diameter.

We had a third period which began late in 1922, since which time we have used 210 kv. In the first period we had 108 patients, in the second period 125, in which with the 140 kv. roentgen rays with radium the results were improved, while in the third, with 220 kv., the results have improved considerably. There is no question that the improvement in technique has influenced our end-results.

DR. HENRY J. ULLMANN, Santa Barbara, Calif., asked whether they were operating on any carcinomas of the cervix at Rochester, early or late.

DR. O. L. NORSWORTHY, Houston, Texas. The time has come when this society should adopt a histological classification of malignancies. The American College of Surgeons has appointed a committee in an effort to decide on a classification of cancer. This society should be of assistance in that effort. Neither evaluation nor standardization of treatment can be accomplished without histological classification of the type of disease to be treated.

I can recall two cases of early cancer of the cervix who died within two years after treatment with radium. Both cases were diagnosed basal cell cancer by our laboratory. Many pathologists teach that basal cell cancer is not to be found in the cervix. These two cases lowered our number of cures in early cases.

Dr. Bowing's report shows but few cases of infected pyometrium. This was likely due to the fact that he treats the cervix before entering the uterus. The patient he reported as dying from hemorrhage had received radium treatment some time before consulting him. She probably received heavy dosage and the amount he applied, though small, resulted in necrosis and breaking of blood vessels in tissues not necessarily the seat of extensive malignant extension.

DR. CHAS. L. MARTIN, Dallas, Texas, stated that for a long time he had been interested in the kidney and ureteral complications which occur in most advanced cases of cancer of the cervix. Stricture formation and hydronephrosis were found very troublesome and he asked Dr. Bowing to say something about his method of dealing with these conditions.

DR. BOWING (closing). In answer to Dr. Ullmann's query he stated that the surgical staff at The Mayo Clinic regarded the management of these cases as a radiotherapeutic problem. The diagnosis of the early and borderline cases in some instances could only be made by removal of material from the cervical canal with a curette. In some cases, it was impossible to be certain whether or not the primary tumor was in the fundus, in which instance operation was indicated. The number of cases operated on last year was not known, but it certainly was small.

He agreed with Dr. Norsworthy's remarks concerning a simple classification based on the site and extent of the neoplastic lesion. The usual headings, "early," "borderline," and "inoperable" are recognized and understood, but should be defined. Further, it is of importance to classify the type of radium treatment applied. It should be our aim to treat all lesions adequately when first seen. Ordinarily, if adequate treatment is applied, the primary field gives very little trouble. Seldom do we see recurrence in the primary field, even in cases of large, inoperable carcinoma. It is usually the field outside of this in which activity develops.

The modified group will probably remain, since individual responses to irradiation cannot be exactly measured or estimated before treatment is applied. As time goes on, it is hoped these numbers will be reduced. In a measure it casts a reflection on the radiotherapist, particularly if adequate treatment could have been applied. In some cases it is necessary to limit the treatment but we must bear in mind that the most opportune time to restore the individual to health is at the time of the first visit, and if adequate treatment can be employed it is the best opportunity we have for restoration to health and usefulness.

Dr. Norsworthy's remark was well taken for it is astonishing to what degree surface healing will occur following the initial applications, thus permitting the deeper areas to be treated with very little if any trauma.

The case in which a fatal hemorrhage occurred was not a result of intensive irradiation. At the post-mortem examination, activity could not be demonstrated at the site of primary tumor. The bleeding occurred following the rupture of the vaginal branch of the uterine artery. The usual methods for the control of hemorrhage were ineffective.

Regarding urological complications, every endeavor is made to place the proper interpretation on them. If they are present before

treatment a cystoscopic examination is indicated. Only one case was noted in which a bladder complication occurred as the result of treatment. It was a late complication occurring four or five years after the treatment and there was a typical atrophic change in the bladder wall. The average cystoscopic report will read, "bulbous edema," "deformity of the base from an extravesical tumor," and so on. With reduction in the size of the cervical tumor the vesical complications usually subside. Hydronephroses are potentials that the patients come to us with, but owing to the reduction of the mass in the treatment field, this complication seldom occurs. If the initial treatment is effective vesicovaginal fistulas will seldom occur. We have seen changes in the rectal mucosa, but a change in the technique has reduced this complication. We must also consider the damaging influence of the carcinoma. It has destroyed the lymphatic and blood supplies. There are sure to be scars, but we should not take all the responsibility of this any more than the surgeon takes the responsibility for the keloids that occur. We should be careful in our selection of treatment factors, and we can reduce to a minimum these distressing complications.

URETHRAL CARUNCLE*

REPORT OF TWO CASES TREATED BY RADIUM

BY R. E. LOUCKS, M.D.

DETROIT, MICHIGAN

CARUNCLE is the most common form of new growth involving the urethral orifice. The next most frequently found neoplasm is carcinoma, with sarcoma third in order and fibroma least frequent of all.

The urethral caruncle is a vascular, papilliferous growth which springs from the mucosa or margin of the urethra. It may be either sessile or pedunculated and presents various shapes and shades of color dependent upon its blood content and the amount of papilliferous epithelium which it contains.

Microscopic section reveals a fibrous mass with an abundant connective tissue framework very rich in blood vessels. There are many infoldings of epithelium producing various islands and crypts of epithelium deep in the connective tissue. This causes the condition to be frequently mistaken microscopically for epidermoid carcinoma. The epithelium is of the transitional or squamous type.

Often the caruncle is extremely sensitive, and this sensitiveness may extend to include the parts at the external orifice, the patient shrinking from the slightest contact and presenting a well-defined case of vaginismus. Even the passing of urine may be the occasion of great pain to the patient. Some writers believe that the caruncle possesses a very rich and extensive network of nerve filaments, but as yet no pathologist has succeeded in demonstrating definitely any unusual arrangement of nerve endings or any excessively rich distribution of nerve fibers.

The pathological picture of urethral caruncle may sometimes be confused with that presented by a gonorrheal infection involving the urethra. In this latter condition, the urinary meatus is found to be red in color, swollen, everted, and excruciatingly tender, the pain on contact equalling that arising from a caruncle. However, the vaginal orifice and contiguous parts can be touched without causing pain, provided that the urethra is undisturbed. Careful observation will readily distinguish the general swelling and reddening of the meatus from the well-defined tumor mass of the urethral caruncle.

Predisposing Causes. Apart from traumatism and infection involving the urethra, the chief etiological factor is continuous irritation. Frequency of micturition is important in this connection. In the female, this frequency may result from pressure upon the bladder during

* Read at the Thirteenth Annual Meeting, American Radium Society, Minneapolis, Minn., June 11–12, 1928.

multiple pregnancies; it may come from a chronic cystitis, secondary to a prolapsed vaginal wall allowing the bladder to sag, forming a vesicocele with an associated kink in the posterior urethra. The irritation may be related to a relaxed vaginal outlet with many folds of the labia majora; to unsanitary conditions, to frequent wiping with rough toilet paper, or anything that keeps up a sodden condition from weakened sphincter control.

Doubtless the chemistry of the urine is an important factor; concentrated, highly acid urine, heavily loaded with irritating crystals such as calcium oxalate, may contribute largely to this condition; also, a urine containing mucus dribbling slowly through the folds would aggravate any of the above complications. Traumatism of the external orifice may occur during labor, from instrumentation, manipulation, pressure from the presenting head, or from repeated catheterization.

Malignant Tendencies. The malignant tendency is not so great as that of recurrence after surgical removal, being in this respect much like a keloid. The papillomatous tumor may, through the continuous irritation mentioned, take on malignant growth, become indurated, ulcerate, and give off metastases to the inguinal lymphatics.

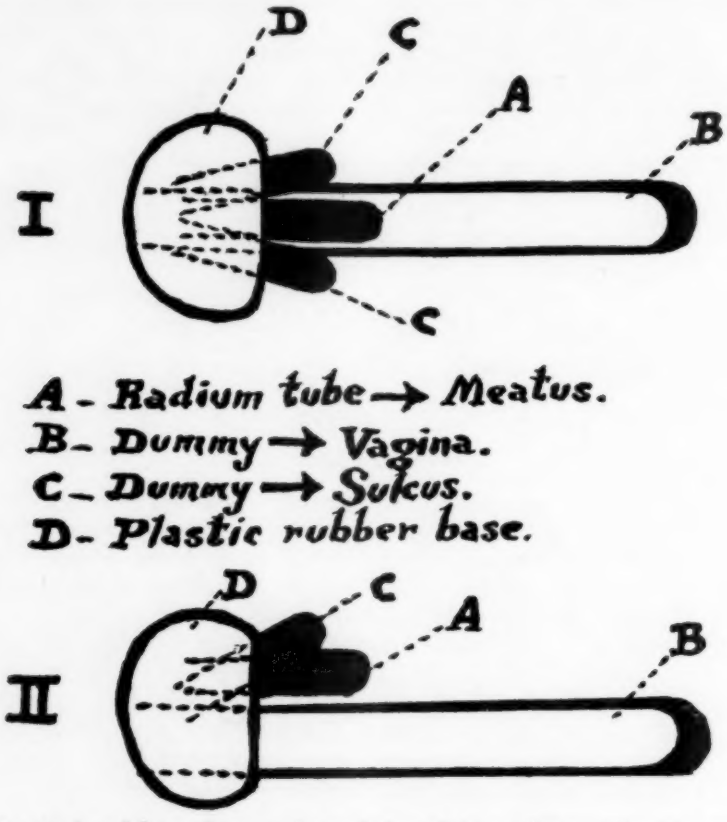

FIG. 1. I. Applicator as viewed from above. II. Lateral view of the applicator. Diagrams represent actual size.

Radium Therapy. Radium has been the therapy of choice for urethral carcuncle in our service for many years. A 25 mg. radium tube in a 0.5 mm. silver capsule is placed in a 1 mm. brass tube, and covered with a rubber cot 0.5 mm. thick, supplemented on the anterior face with an extra millimeter of gum rubber.

The radium tube is placed in a package between two dummies that fit into the sulci on either side of the meatus and prevent the radium tube from being forced too high up. Another dummy tube about 5 cm. in length is attached to the upper three

tubes with gutta percha so that it projects into the upper part of the vagina and also helps to retain the package firmly in position. The type of applicator exhibited and described has proved for many years to be satisfactory.

Medication is advised to render the urine alkaline and lessen irritation after the radium treatment; also, irrigation twice daily with an alkaline solution as a cleansing agent, and the use of an emollient like K-Y as a local sedative at the reaction period.

REPORT OF CASES

Case 1 (No. 294). July 30, 1918. Patient aged sixty-three; married.

Complaint. Sensitive growth in meatus for four years. Family history negative.

History. Patient always enjoyed good health. Is the mother of five sons; had one instrumental delivery; menopause at fifty. Four years ago she had a growth removed surgically, but it soon returned, grew larger and more sensitive, causing discomfort in walking. Three months ago it was operated on the second time and the base was cauterized, but it never healed.

Examination. A red, granular circle 1 cm. in width surrounds the meatus. The mucous membrane of the urethra within the meatus is thickened, reddened and has a mucopurulent discharge on its surface. A small currant-shaped granule lies in the fold at the distal border of the urethra.

Diagnosis. Urethral caruncle. No biopsy was done, but the general appearance is suspicious of malignancy.

Treatment. Twenty-five milligrams radium element, employing the technique described above, was held in the urethra over the growth for five hours.

July 9, 1920 (nearly two years later). The reaction for three weeks following the treatment caused discomfort. The mucous membrane of the meatus is now quite red; there is no ulceration and no evidence of the primary trouble.

This patient died two years ago, or eight years following the treatment, death being due to cardiorenal disease.

Case 11 (No. 618).

Complaint. Painful growth in meatus for fourteen years.

History. Patient is forty-seven years old, married, and has three children; the last child was an instrumental delivery; menopause two years ago. She states that her present trouble commenced after the birth of her last child. For four months, the meatus has been more sensitive, and bleeds with the least trauma.

Examination. The mucous membrane at the distal and lateral sides of the meatus is heaped up and has a deep red color. Where the margins of the meatus blend in front with the mucous membrane of the labia, there is a dark pigmentation extending beyond the sulcus, and into the labial walls. Within the folds of the meatus at the distal part, a rounded, red growth appears, practically filling the lumen. The surface of the tumor shows small blood sinuses, and some denuded patches where the superficial layer of cells has broken down, oozing a blood-tinged serum.

Diagnosis. Urethral caruncle.

Treatment. Twenty-five milligrams radium, using the above technique, was held in the anterior urethra for six hours. A follow-up examination was made every three months for two years. Patient had no pain or discomfort after the reaction had subsided.

SUMMARY

The pathology, predisposing causes and treatment of urethral caruncle are briefly dealt with. Two cases are reported. The tendency to recurrence following surgery or any other form of therapy is emphasized. A proved technique, using a special radium applicator, is described. This technique provides a safe, certain, and convenient method of permanently curing a very troublesome, obstinate and by no means infrequently occurring condition.

ABSTRACT OF DISCUSSION

Dr. Henry Schmitz, Chicago. Dr. Loucks deserves thanks for having brought up this subject, and for giving us such a good technique for the application of radium. It is surely better than the old methods we have used. I do not deny that urethral caruncle may degenerate into a malignant condition but we should be very careful about calling it a malignant degeneration. Primary carcinoma of the urethra does occur, but it is very rare. There is another type of pedunculated growth that may undergo malignant degeneration. The carcinoma remains localized in this pedunculated growth for a long time, and the removal of the growth relieves the condition. We should be very careful in treating these conditions, and should always make a microscopic examination. We incise the growths and if benign

we do not worry about them but if they are malignant we treat them accordingly. In excising them we have to be extremely careful for we have to repair the slight defect in the urethra. If this is not done the direction of the urinary stream may be changed in such a way as to be inconvenient for the patient. We should try radium therapy and if this is not successful I think simple excision should be practised.

DR. J. D. MORGAN, Philadelphia. It is impossible to criticize the treatment Dr. Loucks has given us, but in my experience these growths respond so well to electrodesiccation, the method is so simple and the results so immediate, that I have not used the other measures. I have not seen a case of this sort that was malignant, although this possibility must be kept in mind. Electrodesiccation can be done in the office in a few minutes, gives prompt relief, and if done thoroughly it will destroy the angiomatous condition without a recurrence.

DR. O. L. NORSWORTHY, Houston, Texas. With us radium has practically taken the place of electrocoagulation in the treatment of urethral caruncle. There is no ulceration, no scarring and no deformity following the use of radium, and therefore, less urethral disturbance than that following any other method of treatment. Complete healing following electrocoagulation is extremely slow.

Dr. Loucks' applicator must be a splendid one though somewhat complicated as to construction. We have found the Clark cervical applicator very convenient in treating the meatus of the urethra. By making the stem of the Clark applicator smaller to enable easy introduction into the urethra one will have a splendid applicator. The stem sufficient to carry a 25 mg. tube of 0.5 mm. of pure platinum may be made with or without windows for treating different parts of the meatus. The shoulders may or may not be loaded. Another very simple and satisfactory applicator for the meatus is a straight tube with a piece of wooden applicator or toothpick fastened in the eyelet with a cushion of gauze or cotton attached to it. It is our practice to use 25 mg. with all beta rays eliminated within the meatus for two hours. The treatment is repeated in six to eight weeks if needed. Heavier irradiation has produced a very troublesome irritation although we were careful to eliminate all beta rays.

DR. H. J. ULLMANN, Santa Barbara, Calif. I think we should recognize that we are talking about two different things. The type of lesion Dr. Loucks described is of the papillomatous group and the type mentioned by Dr. Schmitz is entirely different. In the type reported by Dr. Loucks I have used radium successfully.

DR. C. D. BROOKS, Detroit, Mich. Dr. Loucks has had considerable experience with urethral caruncles but he did not discuss malignant growths and I think we should leave them out of our discussion. My surgical experience is that if malignancy occurs the growth is not true caruncle, but began as carcinoma, usually the squamous type. Our experience with radium has not been nearly so extensive as has Dr. Loucks' but in the cases so treated the results have been entirely satisfactory. I think electrodesiccation is a quicker means of destroying the growths, but we cannot carry out this method with local anesthesia. We use caudal or gas anesthesia. If local anesthesia is used there is edema and we cannot tell how much of the tissue should be coagulated. If caudal anesthesia is used the treatment is much more satisfactory. I think the failures are due to improper technique. Anyone who attempts to surgically remove a pure urethral caruncle will cause more trouble than the caruncle itself caused.

DR. CURTIS F. BURNAM, Baltimore, Md. I have seen 25 or 30 carcinomas of the urethra in women. The problem from the standpoint of treatment is different from that of urethral caruncle. For many years the method we relied on in caruncles was operative removal, and it proved very satisfactory. There are some cases that recur after operative removal; the whole urethra might be taken away and they would still recur. More recently we found that a very satisfactory method of treating most simple caruncles was by means of local anesthesia and electrocoagulation. The recurrent type cannot be cured by either of these methods and it gives the patient much trouble. When properly treated with radium it can be cured. Dr. Loucks has reported this type of case, and we are greatly indebted to him for his excellent presentation.

DR. LOUCKS (closing). Patients who have had these growths removed surgically, or by electrocoagulation, and have suffered excruciating pain for several weeks, have, after treatment with radium, told me that the pain and other symptoms have been much less than they had before.

Our technique is somewhat perplexing in appearance, but it is very simple, and may be easily applied after using 2 per cent cocaine for two minutes. The time limit depends upon the condition present. In one suspicious case I left the radium on for six hours, but in the average case I use a four hour application. The anterior portion of the urethra is well protected by brass and rubber filters.

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TUMORS OF THE SALIVARY GLANDS BASED ON A STUDY OF 66 CASES*

BY BERNARD F. SCHREINER, M.D., AND WALTER L. MATTICK, M.D.

BUFFALO, NEW YORK

IN analyzing the records of 6,695 patients accepted for treatment at the State Institute for the Study of Malignant Disease there were found 66 cases of tumors of the salivary glands, making the incidence of salivary tumors about 1 per cent of the total.

Of these 66 cases 30 were in males and 36 in females. The disease had no apparent relation to nativity or race. The Wassermann reaction was positive in 4 cases. A history of cancer in the family was obtained in 20 cases. Facial paralysis was observed in 5 cases on admission, 4 of which were attributed to partial or complete operative interference, the fifth case might have been due to radium implantation with needles; in 3 cases facial paralysis was noted later due to growth of the tumor. The locations of the tumor in order of frequency were as follows:

Parotid region	45
Submaxillary region	7
Hard or soft palate	6
Nose	3
Pharynx	2
Lip	1
Orbit	1
Tongue	1

TABLE 1

CARCINOMA OF THE SALIVARY GLANDS

Case No.	Tumor and Location	First Noticed When	Duration*	Rate of Growth	Previous Treatment	Microscopic Diagnosis	State Institute Treatment	Result
	1917							
5467	Primary-parotid	26	35	Slow 24½ yr., quiescent 10 yr., active 6 mo.	.....	Carcinoma	Biopsy; x-ray	Unimproved, died in 6 mo.
	1920							
6313	Recurring-parotid	54	9	.....	Tumor removed 3 yr. ago	Carcinoma	X-ray and radium pack	Clinically well in 10 mo., recur. in 1½ yr., improved, died 4½ yr. later of arteriosclerosis.
	1921							
6640	Recurring-parotid	42	5	.....	Biopsy neck 4 yr. and 16 mo. ago. Biopsy cheek 11 mo. and 5 mo. ago. X-ray.	(None) Carcinoma	Radium pack	Died 1 yr., 9 mo. later, unimproved.
	1924							
799	Primary-parotid	71	2	Slow over 1 yr., rapid 4 mo.	X-ray	Carcinoma	Biopsy; x-ray, radium tube and radium seeds.	Unimproved, died 16 mo. later.
	1925							
8904	Recurring-parotid	56	1	Slow	X-ray; tumor removed 2 mo. ago	Carcinoma	X-ray	Palliation, died 1 yr., 5 mo. later.
	1926							
1133	Primary-parotid	67	2	Very slow	Tumor removed 3 wk. ago	Adenocarcinoma	X-ray	No recurrence in 2 yr.
9567	Primary-parotid	30	7	Slow past 4½ yr.	Tumor removed 1 wk. ago	Carcinoma	X-ray	No recurrence in 2 yr.
	1927							
10569	Primary-parotid	45	2 mo.	.....	.....	Carcinoma	Biopsy; x-ray, capsule scraped out and radium tube inserted.	Unimproved, developed general metastases 5 mo. later and died within another 2 mo.
10155	Primary-submax	63	11 mo.	.....	Biopsy and x-ray	Carcinoma	X-ray	Unimproved, died 2½ mo. later.
1330	Primary-submax	12	2 mo.	Rapid	Biopsy	Carcinoma	X-ray	Unimproved, died 2 mo. later.
10580	Primary-submax	46	4	Slow	Tumor removed 1 wk. ago.	Carcinoma	X-ray	No recurrence in 7 mo.

* Years unless otherwise noted.

* From the State Institute for the Study of Malignant Disease, Buffalo, N. Y. (Burton T. Simpson, M.D., Director). Read at the Thirteenth Annual Meeting, AMERICAN RADIUM SOCIETY, Minneapolis, Minn., June 11–12, 1928.

According to Ewing[1] three types of tumor occur in the salivary glands: (1) Benign adenoma; (2) malignant adenocarcinoma or carcinoma, and (3) autochthonous mixed tumors.

FIG. 1. (Case No. 10569.) Carcinoma of the parotid, on admittance.

FIG. 2. Same case as shown in Figure 1, four months later.

One case of spindle cell sarcoma is reported in this series originating probably in the capsule of the parotid gland.

Our records fail to show any cases of adenoma of the salivary glands. There were 10 cases of carcinoma and one of adenocarcinoma recorded, 8 were in the parotid region and 3 were in the submaxillary region (Table 1).

After carefully reviewing these 11 cases we find that it is impossible to make a clinical diagnosis from the duration of a tumor occurring in the parotid or submaxillary region as to whether it is a mixed tumor or a carcinoma. Treatment either with radium or roentgen rays has been very disappointing. In 3 cases of carcinoma, where removal of the tumor was followed immediately by high voltage roentgen ray treatment there has been no recurrence in 2 cases for a period of two years, nor in the third for seven months. Usually death occurs from local recurrence or as in the case illustrated (Figs. 1, 2 and 3) with widespread metastases.

Fifty-four cases were recorded as autochthonous mixed tumors. The largest percentage of these so-called mixed tumors showed histologically that they were made up of cells classified by some observers as endothelial, by others as of epithelial origin. Since this paper deals chiefly with the clinical aspects of the disease it is not our intention to enter into a discussion of the classification of this type of tumor; this

FIG. 3. Same case as shown in Figures 1 and 2, five months after admission, at which time metastases were palpable in the axillae and both sides of the neck.

[1] Ewing, J. Neoplastic Diseases, W. B. Saunders Co., Philadelphia, 1928.

is ably discussed by various authorities and presented in a remarkably clear and concise manner by Ewing and very recently by Fry.[1] It is our impression also that these tumors are of epithelial origin.

Fig. 4. (Case No. 6209.) Endothelioma (myxo) parotid region on admittance.

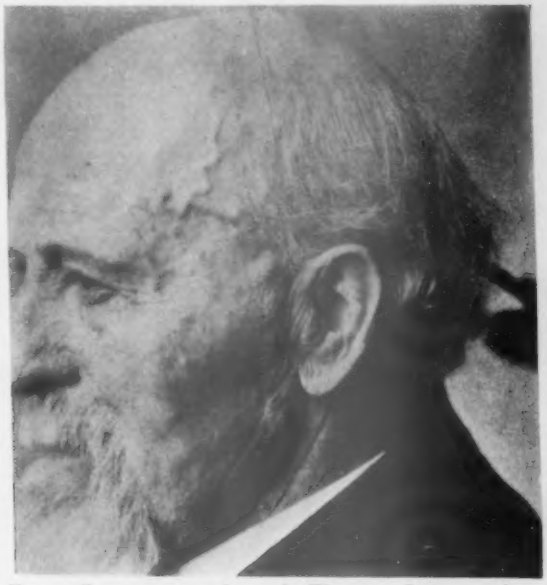

Fig. 5. Same case as shown in Figure 4, five years later (clinically well for eight years).

There were histological examinations on 37 mixed tumors of which:

3 are recorded as endothelioma
4 are recorded as chondro-endothelioma
8 are recorded as myxo-endothelioma
22 are recorded as myxo-chondro-endothelioma.

Table II shows the age incidence when the tumor was first noticed.

Table II

AGE INCIDENCE WHEN TUMOR WAS FIRST NOTICED

1–10	10–19	20–29	30–39	40–49	50–59	60–69	70–69
1	2	11	13	10	9	5	2

(no history in one case)

These mixed tumors occurred at all ages, the greater number fell within the decade 30–39 years, the youngest at nine years and the oldest at seventy-nine years. The duration of the mixed tumors, before patients applied to us for treatment, ranged from two months to fifty-seven years, the most frequent being between one and five years although 4 were of thirty years' duration. Some of these cases gave a history of a quiescent period of from one to thirty years, then a period of increased activity which was recorded as slow growth over a period of one to five years. A history of injury at the site of the tumor was obtained in 6 cases. In 2 of these the lump had been present preceding the injury, in one for over six years and in the other for about twenty-seven years. In both cases there was an apparent stimulation of the growth following the injury. In one case the tumor followed a severe bruise and in the other 3 the history was such that the subsequent development of the tumor could not be associated with the injury.

From a careful survey of the 54 cases of mixed tumors of the salivary glands it is our opinion that where the tumor is favorably located the removal of the tumor, or the enucleation of the tumor, leaving the sac, followed by irradiation, whether with high voltage roentgen rays, radium packs or the insertion of a tube of radium into the capsule, should be the method of choice. Where the tumor is not favorably located on account of injury to the facial nerve or inaccessibility to surgical procedures, irradiation by implantation with gold seeds of emanation, radium packs or high voltage roentgen rays should be resorted to. In the group of cases of postoperative recurrences of the tumor external irradiation or

[1] Fry, R. M. Structure and origin of "mixed" tumours of salivary glands. *Brit. J. Surg.*, 1927, xv, 291–306.

the implantation of emanation is of distinct value.

Of the 54 cases of mixed tumor of the salivary glands, 8 cases refused treatment and the others were treated as follows:

Of these in 3 only did the tumors completely disappear; one has been well for seven and a half years, one for two and a half years and one for four months; all were treated by implantation with radium.

FIG. 6. (Case No. 5984.) Spindle cell sarcoma of the parotid gland, on admittance.

FIG. 7. Same case as shown in Figure 6, five months later.

(*a*) Treatment by surgery and irradiation. Seventeen cases were submitted to surgery and irradiation with radium packs, high voltage roentgen rays or a tube of radium inserted into the wound.

Of these, 14 are clinically well, 3 for a period of six to eight years (Figs. 4 and 5), 3 for four to six years, 3 for three to four years (one treated by surgery only) and 5 have been well over a period of from seven months to three years.

One was well for six years and eleven months and then developed a recurrence which has been well for six months.

One was a recurring case which we scraped out and inserted a tube of radium in the wound with the result that he is very much improved for two years and seven months.

One who was treated with surgery and radium died in eleven weeks from sepsis.

(*b*) Primary tumor treated by irradiation. Sixteen cases of primary salivary mixed tumors were treated by irradiation alone.

Seven cases are clinically well but there remains a hard indurated nodule. These were treated by implantation, radium packs or high voltage roentgen rays and show no evidence of activity, the tumors being smaller but the indurated nodule remaining for periods of seven and a half years, five years, three years (then lost trace of four years ago), two and a half years and 3 for over one year.

One is unimproved after thirteen months.

One was lost trace of one month after treatment.

Four died; one had improved for eight months and then died one month later of epithelioma of the tongue; one was unimproved and died in nine months of lymphosarcoma, and 2 died as the result of the tumor, one in one and a half years and one in seven months.

(*c*) Recurring tumor treated by irradiation. Thirteen cases of tumors recurring after operation performed before admission to the Institute were treated by irradiation only.

Of these, 4 are clinically well for periods of

five years, four years, one year nine months and one year seven months. Two were treated with radium pack, one with implantation of seeds of radium emanation and one with high voltage roentgen rays.

Three are clinically well but there remains a hard indurated nodule at the site of the tumor —one for six years (lost trace of a year ago), another for six years and one for two years (lost trace of two years ago). These were treated with implantation of seeds, pack and high voltage roentgen rays respectively.

Two have had palliation for three years three months and for one and a half years, the first having been treated with implantation and high voltage roentgen rays and the second by implantation only.

One improved for four months and died later of "stomach trouble."

Three died from the disease in four years, two years and in seven months after treatment by radium pack and high voltage roentgen rays or by radium pack alone.

In the case referred to above as spindle cell sarcoma involving the parotid gland the growth evidently originated from the capsule of the gland following a severe contusion. The boy gave a history of being struck with a stone at the site where the tumor developed. Figure 6 shows the condition on entrance and Figure 7 after an effort had been made to treat by means of coagulation and irradiation. This showed temporary improvement but proved fatal seven months after treatment.

SUMMARY AND CONCLUSIONS

1. Two cases of carcinoma of the salivary glands are alive and well two years after treatment by operation and high voltage roentgen rays. One case is well for seven months.

2. Where the tumor is favorably located operation, complete, or removal of the tumor from its capsule, followed by irradiation is the method of choice.

3. Irradiation by implantation with emanation, radium packs or high voltage roentgen rays is preferable when the tumor is not favorably located for operation.

4. Postoperative recurrences of salivary tumors are best treated by irradiation.

In arriving at these conclusions we have taken into consideration the chronicity of the mixed tumors and have endeavored to be conservative in our evaluation of the method of choice in a given case.

ABSTRACT OF DISCUSSION

Dr. H. H. Bowing, Rochester, Minn. Evidently the figure of 1 per cent given by Dr. Schreiner is a representative one, and yet this small number of cases does furnish definite problems for the radiologist. The number of recurrences following surgical measures has been estimated at about 5 per cent. This gives us a rather definite number of patients who will be treated radiologically. The policy in the Mayo Clinic is to remove the primary lesion surgically. If the tumor has perforated its capsule a drainage tube is placed in the wound for the introduction of a radium applicator. Later, when the stitches are removed, surface applications of radium are applied to the operative field; this combination gives reasonable assurance that there is less danger of recurrence. Surgical removal should also be considered in the recurring cases, or buried radium technique, employing needles, gold or platinum seeds, and supplementing either method with surface radium packs. On account of the likelihood of facial paralysis conservative methods should be employed first, and if the tumor is going to be destructive, we should be more energetic.

Dr. O. L. Norsworthy, Houston, Tex. Last November, I saw a young man with both parotid glands much enlarged. All teeth, except three, had been extracted several months before on account of pyorrhea. Our diagnosis confirmed that made by the surgeon referring the case: Mikulicz's disease. We applied 50 mg. radium at a distance of 5 cm. for twelve hours each, totaling 1200 mg-hr. for each gland. The glands reduced promptly and there has been no recurrence.

Dr. G. E. Pfahler, Philadelphia. In my experience these tumors are very likely to recur and are very difficult to cure either by operation or irradiation. Probably a combination of the two is best. My choice is to treat first with heavy pack surface irradiation and after the tumor is reduced to a stationary stage add some irradiation by inserting radium needles.

Dr. C. D. Brooks, Detroit, Mich. It is our practice to have these tumors treated by conservative irradiation and perform radical operation if possible. If this is not possible, we leave the capsule in, as Dr. Bowing mentioned, and then implant radium needles on the day of the operation. It is most important to get the radium capsule in contact with the tissue that is left at the time rather than wait until later. After the wound is entirely healed

we believe that radium acts better in these tumors than roentgen rays. This is my opinion rather than a matter of fact.

DR. C. F. BURNAM, Baltimore, Md. In the early days of treatment of salivary tumors, particularly of the parotid gland, they were thought to be quite radiosensitive. The large majority of cases are inoperable, and while these individuals live a long while and apparently do fairly well, I dislike to see them come to the hospital. These growths are common in young individuals.

DR. MATTICK (closing). Our usual aim is to get the patient to the surgeon for enucleation of the tumor. If this is impossible, we scrape out the capsule and insert radon tubes of 0.5 mm. gold and 0.5 mm. brass filter, leaving them in for 400 to 600 mg-hr. in very intensive dosage. Formerly cases were treated by glass seeds, before we had the gold seeds. In other cases in which the radium treatment was refused, or we thought it was not advisable to use it, we used high voltage roentgen rays, giving a good depth dose. We find the results in all these cases are more or less alike. The best procedure seems to be to remove as much of the tumor as possible, and administer gamma and highly filtered roentgen radiation.

STATISTICAL ANALYSIS OF THE RADIATION TREATMENT OF CANCER OF THE BREAST ON THE BASIS OF THE SATURATION TECHNIQUE, 412 CASES (1920–1928)*

BY G. E. PFAHLER, M.D., AND B. P. WIDMANN, M.D.

PHILADELPHIA, PENNSYLVANIA

IN 1925 we presented before this Society a detailed analysis of 801 cases of cancer of the breast, treated by radiation. Statistical values were based upon three- and five-year results in 590 cases (1900–1922). Up to the present time (1928), 1066 breast cases have been treated by radiation in Dr. Pfahler's private office. The three- and five-year results have been determined in 302 additional cases (1920–1925) on the basis of the saturation technique of irradiation.

The end-results are affected not only by the type of cancer, but by the age of the patient, the stage and rapidity of the growth, the extent of metastasis, regions invaded, the physical resistance of the patient, duration of the symptoms before operation and irradiation, also by the duration of the recurrence.

In this series since 1920, in 25 (6 per cent) of 412 cases, irradiation alone was used. These were primary operable cases, in which operation was refused or contraindicated. The diagnosis in these cases was not made microscopically but clinically. It is well known that most breast amputations are done on clinical evidence.

There were 105 cases which received postoperative, or both pre- and postoperative treatment. Of these, a microscopical diagnosis was reported to us in 81 cases. In 24 cases, the disease was so far advanced that the surgeon presumably did not consider a microscopical diagnosis essential. The cases receiving preoperative treatment are advanced and generally inoperable.

There can be no question about the diagnosis of malignancy in the recurrent and inoperable group. The original pathological reports in some of these *advanced recurrent cases* showed when the primary lesion was originally examined, benign tumors (3 cases), fibroadenoma (2 cases), and cyst not malignant (1 case). This illustrates that microscopical sections sometimes may not contain the malignant areas, and negative reports frequently will lead to much error and confusion, particularly when the clinical evidence indicates carcinoma.

The age incidence shows more cases

* Read at the Twenty-ninth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Kansas City, Mo., Sept. 25–28, 1928.

occurring between forty and fifty than at any other period of equal length. The youngest patient was twenty-eight; the oldest eighty-three years of age.

TABLE I

Years	No. Cases	Years	No. Cases
20–30	1	55–60	86
30–40	36	60–65	14
40–45	78	65–70	11
45–50	94	70–75	7
50–55	82	78–80	2
	—	80–90	1
		Total.....	412

In 1925, we analyzed 801 cases and found that the average time between the patient's discovery of the breast condition and operation was seventeen months. A similar analysis of the 302 additional cases in this series shows an average time of fourteen months. This estimation includes the early and advanced cases. Only 14 cases, or 4 per cent, applied for any kind of treatment within four weeks after discovering the condition.

The average time for the inoperable cases from the first recognition of symptoms to radiation treatment was approximately twenty-two months. During recent years, education of the public has greatly diminished the length of time from the first recognition of symptoms to treatment. Ewing places the average preoperative time at about 13.28 months. Greenough, in the report of the Massachusetts General Hospital, showed an average of 7.5 months in cases studied from 1918–1920, inclusive, illustrating the value of educating the public to report for early treatment. Greenough's report is on operable cases. Our own study includes many *advanced recurrent* and *late inoperable* cases. The average duration of symptoms preceding operation and roentgen treatment (fourteen months), as indicated above, shows that in our clinic we have been dealing with very advanced cases.

The average duration of time from the first recognition of the recurrence to the beginning of roentgen treatment was 9.5 months; the records of 170 of these patients were sufficiently accurate to give the above average. This long period also indicates the advanced type of cases with which we have had to work.

TABLE II

DURATION OF SYMPTOMS BEFORE PATIENT APPLIED FOR ANY KIND OF TREATMENT

(Average 14 months)

	No. of Cases
Less than 1 month.....	14
1 to 6 months.....	76
6 months to 1 year.....	83
1–2 years.....	61
2–3 years.....	42
3–5 years.....	19
5– years.....	7
Total.....	302

TABLE III

AVERAGE TIME INTERVENING BETWEEN RECURRENCE AND ROENTGEN TREATMENT (9.5 MONTHS)

Treatment Started	No. Cases	Treatment Started	No. Cases
2 weeks.....	31	7 months.....	3
3 weeks.....	14	8 months.....	5
4 weeks.....	15	9 months.....	3
5 weeks.....	9	10 months.....	14
6 weeks.....	13	11 months.....	9
7 weeks.....	11	12 months.....	11
8 weeks.....	13	1½ years.....	9
3 months.....	6	2 years.....	6
4 months.....	11	3 years.....	7
5 months.....	7	4 years.....	8
6 months.....	15	5 years.....	1
	—	Total.....	170

In the recurrent group the average period of time from operation to the time at which the patients were referred for roentgen treatment was one year and two months. In a previous series (1900–1920) this factor was one year and four months. The factor of one year and two months in the present series is based upon a study of 99 cases in which the records were sufficiently complete; 53, or 58 per cent, of these cases recurred within six months. This further illustrates the advanced or virulent type of cases which is operated upon and then referred later for roentgen treatment. Bunts, in reporting end-results of surgery in 600 cases, finds that 28.5 per cent recurred within six months.

The classification of the types of cases and extent of involvement in 412 cases are shown in Table v. It is interesting to note that the series of 801 cases (1900–

TABLE IV
AVERAGE TIME DURATION FROM OPERATION TO RECURRENCE (1 YEAR 2 MONTHS)

Recurrence within	Cases	Recurrence within	Cases
1 week	1	7 months	2
2 weeks	4	8 months	1
3 weeks	2	9 months	3
4 weeks	5	10 months	2
5 weeks	1	11 months	4
6 weeks	6	12 months	13
7 weeks	2	1½ years	2
8 weeks	3	2 years	9
3 months	8	3 years	5
4 months	7	4 years	2
5 months	3	5 years	3
6 months	11		
	—		—
		Total	99

1920) as compared with this series of 412 cases (1920–1928) does not differ appreciably in the relative number of cases in any of the different groups. The greatest difference found is in the postoperative group. In 812 cases (1900–1920), only 25 per cent can be classed as postoperative cases. In this series of 412 cases (1920–1928), only 19 per cent can be classed as postoperative cases.

Table v further subdivides the cases into Groups I, II, III and IV, according to the usual surgical classification: (I) early operable—no glands involved; (II) late operable with glands involved; (III) local recurrences—operable; (IV) inoperable primary and secondary.

Of all cases in Group I in this series (1920–1928), only 41 cases, or 10 per cent, were early operable cases without gland involvement, and 25 of these 41 cases, or 61 per cent, were primary operable cases treated by radiation alone, because operation was refused or contraindicated. This leaves only 16 cases (approximately 4 per cent) out of 412 cases that can be classed as early operable cases, without gland involvement, to receive irradiation with operation.

In the postoperative series (*b*) (1920–1928), there were only 74 cases, and 61, or 82 per cent, of these had gland involvement and were late cases.

Local recurrence was found in 94 cases out of 184 postoperative recurrences, but in every instance except 3 cases, was accompanied by gland and sometimes chest involvement.

The total of Groups I, II and III, in this series (1920–1928) shows only 112 cases, or 27 per cent, of 412 cases that belong to the operable cases, and form the only group that can be compared with surgical statistics. This leaves 300 cases, or 73 per cent, that are regarded as advanced or hopeless, and must either be abandoned, or be given the benefit of radiation treatment.

Two hundred and eighty-two, or 68 per cent, of 412 cases (*c* and *d*) were primary inoperable, recurrent and metastatic; 184 cases (*c*) or 44 per cent of the 412 cases were advanced recurrent cases with metastasis to glands and chest; 98, or 24 per cent, were primary inoperable cases. This 24 per cent group includes all cases with fixation of the tumor to the skin or chest wall, with involvement of the axillary and sometimes supraclavicular glands, and frequently the mediastinum. Of the 184 recurrent cases, 110, or 62 per cent, showed demonstrable roentgen-ray evidence of disease in the mediastinum at the beginning of roentgen treatment. Of the 98 primary inoperable cases, 75 or 77 per cent, showed mediastinal involvement at the beginning of the treatment; 39 (*m*, *n* and *p*), or 15 per cent, of the advanced cases showed bone metastasis at the beginning of treatment.

In the primary operable group (*e*) 25, or 6 per cent, received radiation treatment without operation. These cases refused operation or were physically unfit.

ESTIMATION OF LIFE IN MAMMARY CANCER WITH RADIATION THERAPY

We have classified these cases in the preceding tables in such manner that they can be compared with surgical treatment, with no treatment, and with regard to the total duration of life from the beginning of the disease. We have followed the classification and system of comparisons in a previous paper on breast cancer (1900–1920) (Table v). The relative percentages in the various groups have not appreciably changed in the two series.

When a patient could not be traced, we recorded the case as having lived so many

TABLE V

CLASSIFICATION OF TYPES AND EXTENT OF INVOLVEMENT IN 701 PRIVATE OFFICE CASES (1900–1920) AS COMPARED WITH 412 CASES (1920–1928)

	Group	Before Operation Glands	After Operation Glands	Series 1900–1920 Number Cases	Series 1900–1920 Per Cent	Series 1920–1928 Number Cases	Series 1920–1928 Per Cent
a. Both Preoperative and Postoperative Treatment							
A	I	No	No	8	18	3	9
B	II	Yes	No	24	56	19	61
C	IV	No	Yes (not removable)	2	5	2	7
D	IV	Yes	Yes (not removable)	9	21	7	23
			Total	43	6	31	7
b. Postoperative Treatment							
E	II	Yes	No	86	49	49	66
F	IV	Yes	Yes	63	36	9	12
G	I	No	No	22	13	13	18
H	IV	No	Yes	3	2	3	4
			Total	174	25	74	19
c. Recurrent Cases							
I	III		Local Recurrence	13	4	3	2
J	IV		Local rec. glands ax. and supcla. regions	43	15	59	32
K	IV		No loc. rec., metas. mediastinum-lungs	13	4	4	2
L	IV		Loc. rec. ax. supcla. and mediastinal	199	67	94	51
M	IV		No. loc. metas. to spine and other bones	7	2	9	5
N	IV		Metastasis-mediastinum, lungs and bones	23	8	15	8
			Total	298	43	184	44
d. Primary Inoperable Cases							
O	IV		Fix. sk. or ch., ax., s. cl. and medias. dis.	117	82	44	45
P	IV		Fix. sk. or ch., ax., s. cl. plus bone metas.	5	3	15	15
Q	IV		Made operable without chest metas.	13	10	31	32
R	IV		Made operable with chest (palliative)	5	3	6	6
S	IV		Removed by electrocoagulation	3	2	2	2
			Total	143	20	98	24
e. Primary Operable Cases							
V	I		Prim. operable (refused phys. not fit)	43	6	25	6
T	I		Prim. operable questionably malignant 12, or 2 per cent				
			Total	701	..	412	

The groups under each subdivision are classified after the fashion of the generally accepted surgical tables.

Group I ..... *Early* operable—no glands involved.
Group II ..... *Late* operable with glands involved.
Group III ..... Local recurrence—operable.
Group IV ..... Inoperable—primary and secondary.

years to the time of the last record. Every case is entered, and every case applying for treatment is included in the statistics. whether the patient was treated, refused to complete treatment, was hopeless from any standpoint of treatment, or the records were incomplete because we could not follow the case to its termination. We therefore recorded a case as being dead when it could no longer be traced. This assumption, however, has not always been true and may not give radiation its full

TABLE VI

DURATION OF LIFE AFTER BEGINNING RADIATION TREATMENT (SATURATION) (302 CASES—1920–1925)

	Group	Number Months Alive								Number Years Alive									Total
		5	6	7	8	9	10	11	12	1½	2	2½	3	3½	4	5	6	7	8	
a. Preoperative and Postoperative Treatment																			
A	I	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	2
B	II	..	..	..	..	..	..	..	1	..	1	..	3	2	2	4	..	1	1	15
C	IV	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	2
D	IV	..	..	..	..	..	..	..	1	..	..	1	1	..	..	1	..	..	..	4
b. Postoperative Treatment																			
E	II	2	..	..	1	..	..	..	1	..	1	1	7	2	5	7	4	..	3	34
F	IV	2	..	1	..	..	..	..	1	..	.	..	..	1	1	..	..	..	..	6
G	I	..	..	..	..	..	..	..	..	..	...	..	2	..	..	3	..	3	1	9
H	IV	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	2
c. Recurrent Cases																			
I	II	..	..	..	..	..	..	..	..	..	..	. .	..	1	..	..	1	..	..	2
J	IV	6	5	..	1	..	1	..	2	1	4	4	6	2	1	7	1	..	4	45
K	IV	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	2
L	IV	6	3	2	2	1	2	2	9	6	3	6	9	9	6	7	1	..	2	76
M	IV	2	..	1	..	..	..	..	2	1	..	..	1	2	..	..	..	..	..	9
N	IV	4	..	..	..	..	..	..	1	2	2	..	..	1	1	..	1	..	..	12
d. Primary Inoperable Cases																			
O	IV	4	3	2	1	1	..	..	1	3	1	2	2	3	1	2	2	2	1	31
P	IV	3	2	..	..	1	..	1	..	1	1	..	..	..	1	..	1	..	..	11
Q	IV	..	..	..	..	..	..	..	1	..	1	2	3	1	1	3	2	1	..	15
R	IV	..	..	..	..	..	..	..	2	1	..	..	1	1	1	..	..	..	..	6
S	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
e. Primary Operable Cases																			
V	I	..	..	..	1	..	..	..	..	..	..	..	2	3	1	6	1	1	..	16
T	I	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	2
Total.....		31	13	7	6	4	3	4	23	16	15	16	37	28	21	40	15	11	12	302

value, because frequently some of these cases will return for inspection several years later, free from all palpable evidence of the disease. We believe this will balance any discrepancies that might be weighed against the element of the personal equation in interpreting end-results in this study. Ward and Heyman have applied this same rule in their statistics on carcinoma of the cervix. Twenty cases were so far advanced that no treatment, or only a partial series of a treatment was given. The average length of life in these cases was three to five months from the time of our examination, consequently reducing the total values.

Table VI itemizes the duration of life of each group according to the classification shown in Table V. The duration of life of all cases in all groups is summarized in Table VIII for the three and five year periods.

Of all cases, early and late, operable, advanced inoperable and recurrent, 54.3 per cent were alive three years, and 36.7 per cent alive five years or more, as compared with 50 and 27 per cent respectively in a previous series (1900–1920) (Table IX).

In the postoperative group (G), without gland involvement, 100 per cent were alive three years, and 77 per cent alive five years or more, as compared with 81 and 77 per cent respectively in the series 1900–1920.

In the postoperative group (E) with gland involvement, 82 per cent were alive three years, and 41 per cent were alive

TABLE VII

CASES TREATED IN OFFICE UP TO THE PRESENT TIME GROUPED ACCORDING TO YEARS TREATED

Year	Cases	Alive 3 Years	Per Cent	Alive 5 Years	Per Cent
1920	54	32	59	20	37
1921	45	24	53	16	35
1922	48	25	52	18	37
1923	65	34	52	24	36
Total 5 yrs	212	...	....	78	36.7
1924	49	27	55		
1925	41	22	54		
Total 3 yrs	302	164	54.3		
1926	41				
1927	45				
1928	24 (6 months)				

five years or more, as compared with 56 and 38 per cent respectively for three and five years in the 1900–1920 series.

Of the cases receiving both preoperative and postoperative treatment, group (A), without gland involvement, 100 per cent were alive three years and 100 per cent were alive five years or more.

In preoperative and postoperative group (B) with gland involvement, 86 per cent were alive three years, and 40 per cent alive five years or more. These were largely advanced, and operations were often palliative. These cases were almost entirely borderline operable, and poor risks from a surgical standpoint.

Ewing states that statistics favor the conclusion that operation, on the whole, shortens life in the recurrent cases, and in the great majority, aggravates the suffering.

In the advanced recurrent and metastatic group (J-K-L-M-N) out of 144 cases, 61, or 42.3 per cent, were alive three years, and 23, or 16 per cent, alive five years or more. Compared with 38 and 12 per cent respectively for three and five years in the 1900–1920 series, there is a decided improvement in the statistics following the use of the saturation technique. These cases as a whole are so advanced that practically they may be considered as being in the terminal stages of the disease at beginning of treatment. Of these 144 cases, 96, or 67 per cent of this group showed demonstrable roentgen-ray evidence of mediastinal metastasis at the beginning of roentgen treatment.

TABLE VIII

TOTALS OF TABLE THREE AND FIVE YEAR AVERAGES—(302 CASES)

a. Both Preoperative and Postoperative Treatment

	Group	Total	Alive 3 Years	Per Cent	Alive 5 Years or More	Per Cent
A	I	2	2	100	2	100
B	II	15	13	86	6	40
C	IV	2				
D	IV	4	2	50	1	25
		23	17	74	9	39

b. Postoperative Treatment

E	II	34	28	82	14	41
F	IV	6	2			
G	I	9	9	100	7	77
H	IV	2				
		51	39	76.5	21	41

c. Recurrent Cases

I	III	2	2	100	1	50
J	IV	45	21	46.6	12	26.6
K	IV	2				
L	IV	76	34	44.7	10	13.2
M	IV	9	3	33.3		
N	IV	12	3	25	1	8
		146	63	43.1	24	16

d. Primary Inoperable Cases

O	IV	31	13	42	8	25.8
P	IV	11	2	18	1	9
Q	IV	15	11	73	6	40
R	IV	6	3	50		
S	IV	1	1	100	..	100
		64	30	47	15	23.4

e. Primary Inoperable

V	I	16	14	87	8	80
T	I	2	1	50	1	50
		18	15	83.3	9	50
Total		302	161	54.3	78	36.7
			(212 cases observed 5 years)			

The average life of this group after starting roentgen treatment was two years and seven months (Table VI). If we add to this the average time from operation to recurrence, which was one year and two months, we have a duration of life of three years and nine months from the time of the operation. The average time from the discovery of the lump to operation was one year and two months, making a total

TABLE IX

FOR COMPARISON WITH THE USUAL SURGICAL LONGEVITY TABLES THE FOLLOWING GROUPING QUICKLY SUMMARIZES THE RADIATION VALUES.

	Group	Series 1900 to 1920					Series 1920 to 1928				
		Total Cases	Alive 3 Years	Per Cent	Alive 5 Years	Per Cent	Total Cases	Alive 3 Years	Per Cent	Alive 5 Years	Per Cent
I	Early operable no glands.....	67	57	85	45	68	29	26	89.6	18	63
II	Late operable with glands....	81	55	68	38	46	49	41	83.6	20	40
III	Recurrent operable.....	13	9	69	7	54	2	2	100	1	50
IV	Advanced rec. and metas. and prim. inop.....	429	172	40	70	16	222	95	42.8	39	17
	Total.....	590	293	50	160	27	302	164	54.3	78	36.7*

* (212 cases observed 5 years.)

duration of life from the first recognition of the disease to its termination of four years and eleven months, or fifty-nine months in these advanced, recurrent and metastatic cases. This estimation includes 9 cases in which the disease was so far advanced that no treatment was given, or only slight treatment as a placebo, also 17 cases in which radiation could not be properly given. Twenty-one of these recurrent cases are still living and the longevity cycle will be increased considerably during the next year. In the first series (1900–1920) this same group showed a life cycle from first recognition of symptoms to termination of five years and six months. We believe that this series will surpass the previous mark when sufficient time has elapsed.

The advanced primary inoperable group (O-P-Q-R-S) shows, in 98 cases, 47 per cent alive three or more years, and 23.4 per cent alive five years or more, as compared with 41 and 20 per cent respectively in the 1900–1920 series. Sixty-seven cases, or 69 per cent of this five-year group, showed demonstrable roentgen-ray evidence of metastasis in the chest or bones, at the beginning of treatment. Yet the average duration of life from the beginning of roentgen treatment was thirty-two months, as compared with forty months in the 1900–1920 series. This difference is apparent from the fact that 13 patients in this last series have not been observed sufficiently long, and are still in good physical condition, and the life cycle in this group will probably be increased ten to twelve months. The time from the first recognition of the disease to roentgen treatment in this advanced group averaged twenty-two months in 73 of 98 cases so analyzed. Therefore, with radiation treatment, we have a duration of life in this advanced inoperable group from the beginning of the disease to its termination of four years and six months, or fifty-four months. Lee and Herendeen, in 57 cases which they class as "less advanced primary inoperable" carcinoma of the breast, find the average duration of life from the time the growth was discovered to be four years, or forty-eight months, with proper irradiation.

Finney, in Keen's surgery, gives the average duration of life in the untreated cases as twenty to twenty-eight months from the beginning of the disease. Sprengle, Odekop, Sibley, and Paget, quoted by Ewing, and Daland, have estimated twenty-seven, twenty-nine, thirty-four, forty-eight and forty months respectively, as the duration of life in cancer of the breast that receives no treatment. The average duration of life with no treatment is, therefore, thirty-four months, as compared with fifty-four months when radiation is used.

Fifteen cases of our inoperable primary group, with no demonstrable mediastinal disease, became operable under irradiation and give an average life of four years up to the present time (Table VI). The total duration of life in these cases cannot yet be determined.

In the primary operable group (V-T) 15 cases, or 83.3 per cent were alive three years, and 50 per cent were alive five years

TABLE X
STATISTICS OF OPERABLE CASES

	Surgery Alone		Surgery and X-ray	
	Alive 3 Years, Per Cent	Alive 5 Years, Per Cent	Alive 3 Years, Per Cent	Alive 5 Years, Per Cent
Crile prior to 1924	28.1	23.1	16.8	35.8
Crile since 1924	24.0	....	73.5	
Lee	21.0	....	46.0	
Rostock	32.7	....	47.5	
Walther	32.0	....	77.0	
Anschütz	48.0	....	50.0	
Rahm	27.5	....	30.0	
Lehmann	32.0	....	55.0	
Shoute and Orbaan	42.3	39.5	57.0	44.0
Schmitz	....	....	....	53.0
Pfahler and Widmann	....	....	75.2	40.0
Average	32.0	31.3	58.3	43.2
Surgery results from 32 clinics	38.6	28.8		

or more after radiation treatment alone. This group refused operation, or there were surgical contraindications to operation. The time is too short to properly evaluate the five-year group as many of these cases are still apparently free of disease, and the five-year percentages will be greater for the next year.

At the present time, many surgical clinics are able to show a decided advantage from postoperative irradiation. Of the operable cases, Crile (1924) obtained 23.1 per cent cures for five years with surgery alone, and 35.8 per cent with surgery and irradiation. Since 1924, he reports 24 per cent for three years, with surgery alone, as compared with 73.5 per cent with irradiation and surgery in operable cases.

Rostock obtained 32.7 per cent cures for three years with surgery, and 47.5 per cent with surgery and irradiation.

Lee obtained 32.7 per cent cures for three years with surgery alone, as compared with 47.5 per cent cures with irradiation and surgery.

Lehmann obtained 32.3 per cent three-year cures with surgery alone, as compared with 55 per cent three-year cures with irradiation and surgery.

Schoute and Orbaan obtained 42.3 per cent three-year cures, and 39.5 per cent for five years with surgery alone, as compared with 57 per cent cures for three years, and 44 per cent cures for five years with irradiation and surgery.

Walther obtained 32 per cent cures for three years with surgery, and 77 per cent with surgery and irradiation.

Anschütz obtained 48 per cent cures for three years with surgery, and 60 per cent with surgery and irradiation.

Schmitz obtained 53 per cent cures for five years with surgery and irradiation.

Pfahler and Widmann, with irradiation after surgery, obtained 75.2 per cent cures for three years, and 40 per cent cures for five years. We may expect this percentage to increase as more cases have time to pass the five-year period.

In thirty-two clinics surgery alone shows an average of 38.6 per cent three-year cures; 28.8 per cent five-year cures (Portmann) as compared with 58.3 per cent three-year cures, and 43.2 per cent five-year cures with surgery and irradiation (average of ten clinics, Table x).

Walther studied a series of 61 reports covering a thirty-year period on the three-year results from surgery alone in 9,000 breast cancers, and estimates the surgical curability at 31 per cent.

The surgical results in 2000 cases quoted by Willis show three-year cures in 31.2 per cent. Seventy-three per cent of the patients referred to us for radiation treatment were advanced recurrent or inoperable cases. At the end of three years, 60 per cent of the recurrent cases and 30 per cent of the inoperable cases are still alive following radiation treatment.

Webster's analysis of 600 cases showed undoubted superior end-results when irradiation was combined with surgery, and decries the fact that its use is almost entirely restricted to the hopeless type of patient as was the practice for so long in cancer of the uterus.

The average curability of cancer of the breast is 58.3 per cent for three years by surgery and irradiation. This represents an average of ten large clinics (Table x) and amply justifies the radiologists' clinical impression of superior results when breast surgery is carried out in conjunction with irradiation.

When we compare the end-results of all

of the patients treated in the 1900–1920 series as showing 50 per cent alive three years, and 27 per cent alive five years, with 54.3 per cent alive three years, and 36.1 per cent alive five years, in the 1920–1928 series, it is evident that there is a very substantial improvement in the cases of cancer of the breast given irradiation using the saturation technique, which has previously been described.

SUMMARY AND CONCLUSIONS

1. Our records show a definite improvement in end-results following radiation treatment.

2. The recurrent cases with glandular and mediastinal metastases show a postoperative life of forty-five months with irradiation, as compared with twenty-seven months when surgery alone is used.

3. The inoperable primary cases show an average life of fifty-four months when treated by radiation, as compared with thirty-four months when no treatment is given.

4. In an average of the statistics from ten clinics in which surgery and irradiation were used, 58.3 per cent three-year and 43.2 per cent five-year cures, as compared with the surgical results alone in thirty-two clinics in which there were only 38.6 per cent three-year cures, and 28.8 per cent five-year cures. This shows an improvement of 50 per cent in both the three- and five-year cures as a result of postoperative irradiation.

5. As to the value of the saturation method, we find in the late operable group 83 per cent three-year cures as compared with 68 per cent by previous methods, or a gain of 22 per cent; 82 per cent of the postoperative cases in this series had gland involvement.

6. We can therefore recommend irradiation in all cases of carcinoma of the breast, with or without surgery, according to the indications.

7. In 590 cases previously analyzed (1900–1920) we found 27 per cent of all types of cases, early and late, operable and inoperable, free from demonstrable disease at the end of five years, and now find in 302 additional cases (1920–1925) 36.7 per cent, or a gain of 36 per cent. In addition to the saturation method used during this period, we also used the high voltage roentgen rays which we had not been using previously (1900–1920).

8. In all breast cases we advise a routine roentgen study of the chest, spine, and pelvic bones before beginning treatment. Not infrequently metastases will be found when not suspected, at the beginning of treatment.

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A ROENTGEN CONSIDERATION OF THE TEMPOROMANDIBULAR JOINT*

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A SEARCH through the medical and dental literature of the past eleven years shows that surprisingly little has been written on the roentgenology of the temporomandibular joint. The majority of the articles found are surgical reports. In these the roentgenographic aspect of abnormal conditions of this joint has been dismissed with such remarks as, "The skiagraphs were unsatisfactory as they are likely to be,"[4] or "Roentgenograms of the joint itself are usually of little value,"[6] or "It is sometimes extremely difficult to get satisfactory roentgen pictures but when obtained they are of great value."[12] The illustrations are equally uncomplimentary to the roentgenologist. They are either conspicuous by their absence or unconvincing by their presence, so that I feel justified in presenting a roentgenographic study of this joint with a technique that has proved satisfactory during more than two years of use. Our association in the hospital with an active oral-surgical service has shown us many unfortunate results in referred cases that seem to have been diagnosed incorrectly and, as a result, treated inadequately.

ANATOMY

Since the abnormalities to which this region is subject, and the difficulties in showing it roentgenographically are largely anatomical, a brief review of the anatomy of the region will not be amiss.

Cunningham[3] defines this joint as an arthrodial diarthrosis; that is, a highly developed joint with a free range of movement in which a gliding motion is a prominent factor. The joint occurs between the glenoid fossa of the temporal bone and the condyle of the mandible. The glenoid fossa lies below and between the two roots of the zygomatic process of the temporal bone and just anterior to the external portion of the auditory canal. From a roentgenographic viewpoint this is one of the most dense and complicated shadow areas of the entire body. The shallow fossa is limited in front by a slight eminence, the articular tubercle, which, with the anterior two-thirds of the fossa, is covered with hyaline cartilage and becomes the articular surface of the joint. Between the fossa and the condyle of the mandible is a disc of fibrocartilage which is moulded into the fossa above and over the condyle below, thus compensating for the incongruity between the two articular surfaces. This disc is attached around its edge to the joint capsule, dividing the joint into two separate cavities.

The hinge motion of the joint takes place between the condyle and the disc, while the gliding anteroposterior motion is largely between the disc and the fossa. At rest the condyle lies in the fossa against the posterior wall of the tubercle but when the mouth is opened the condyle glides forward until it rests somewhat in front of the most prominent part of the tubercle. The same motion, to a slightly limited degree, takes place when the jaw is simply protruded. This is demonstrated in Figures 1*a*, 1*b* and 1*c*.

ACUTE TRAUMATIC INJURIES

The abnormal conditions in which a roentgenological examination is of value are varied. Most frequent, of course, are the acute injuries to the mandible: fractures, dislocations and various combinations of the two.

Dislocations. That dislocations so frequently occur during the act of yawning, or other forcible opening of the mouth, is easily appreciated when the normal anterior excursion of the condyle is considered, there being only the joint capsule and the ligaments to retain it in the joint. In old age, atrophy of the tubercle and changes in the angle between the ramus and the body

* Read at the Twenty-ninth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Kansas City, Mo., Sept. 25–28, 1928.

of the mandible are said also to be contributing factors. Uncomplicated cases of dislocation, in which there is no direct trauma as a contributing factor, might be termed "simple dislocations."

Fig. 1*a*. Mandibular joint of a normal subject with the mouth closed and relaxed.

Fig. 1*b*. Showing the normal anterior excursion of the condyle in the same joint when the patient's mouth was widely opened.

There is another group in which the dislocation occurs associated with one or more fractures of the mandible. The most frequent of these are fractures of the neck. To avoid repetition they will be discussed later under that heading.

Case I. Patient E. P. This is a case of a dislocation that occurred during a yawn. Strangely, the roentgen-ray evidence is not striking in this case (Fig. 2). In fact, the displacement is not so marked as the normal excursion of the condyle, shown in Figures 1*b* and 1*c*. Yet, from the clinical evidence the case was unmistakably one of dislocation and after reduction another roentgenogram showed the condyle resting normally in the fossa. I know of no way to differentiate on films between the functional anterior excursions of the condyle and true dislocations, unless it is by being positive that the mandible is in a normal relaxed position when the roentgenograms are taken. Perhaps if an anteroposterior film had been made in this case it would have shown the condyle to be displaced outward.

Case II. L. T. This patient had several teeth extracted under novocaine anesthesia in the hospital dental clinic. At this time no difficulty was encountered. Seven weeks later she returned with a bilateral dislocation (Fig. 3). She could not tell just when this occurred but said she had been too sick otherwise to return sooner. She was admitted to the ward and the dislocations were reduced with some difficulty.

Fractures of the Neck. These may be isolated fractures or they may occur in association with fractures elsewhere in the mandible. In the former, of course, attention is called to them at once by the symptoms, and roentgen study may disclose a simple fracture with comparatively little displacement (Fig. 7). Any one of a number of associated conditions, depending on the type of trauma and the amount of displacement, may also occur. The most

Fig. 1*c*. The same joint with the mouth closed but with the mandible protruded.

frequent of these is a downward and forward dislocation of the condyle (Figs. 6 and 8). In fact, in this series these cases were more frequent than the simple fractures. It is of importance that this condition be recognized and not confused with a sim-

ple dislocation. Given a case with a history of direct trauma to the mandible in which the roentgenograms show an empty glenoid fossa, especially if reduction by manipulation is unsuccessful, a careful search must be made for a fracture of the neck as open operation is nearly always necessary to correct either the dislocation or the fracture and restore function. In Case III (A. J., Figs. 4 and 5) the condyle on the side of the fracture remained in place but the opposite condyle was dislocated by the displacement of the main portion of the mandible. This was a compensation case in which the condition was not recognized or corrected at the time of the injury. The result is a disfigured jaw and a serious disturbance of function.

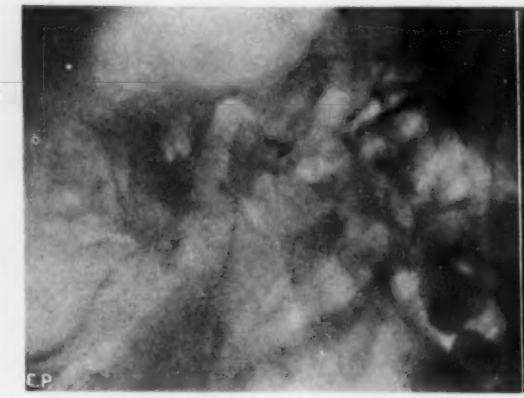

FIG. 2. Case I. Partial dislocation of the condyle.

FIG. 3. Case II. The right side of a bilateral anterior dislocation.

CASE IV. Patient F. C. Nine months previous to admission to the hospital the patient was struck on the chin by a falling piece of timber. A diagnosis of dislocation is said to have been made at that time and reduction attempted. On admission he had partial function of his jaw. With difficulty he was able to open his mouth about 50 per cent but he was unable to get his teeth together. Roentgen examination showed a fracture of the neck of the mandible and a dislocation of the condyle (Fig. 6). At operation the condyle was found to be resting on the anterior rim of the fossa. There was some slight callus formation and beginning ankylosis. A good functional result was obtained and ankylosis avoided by beginning motion at once.

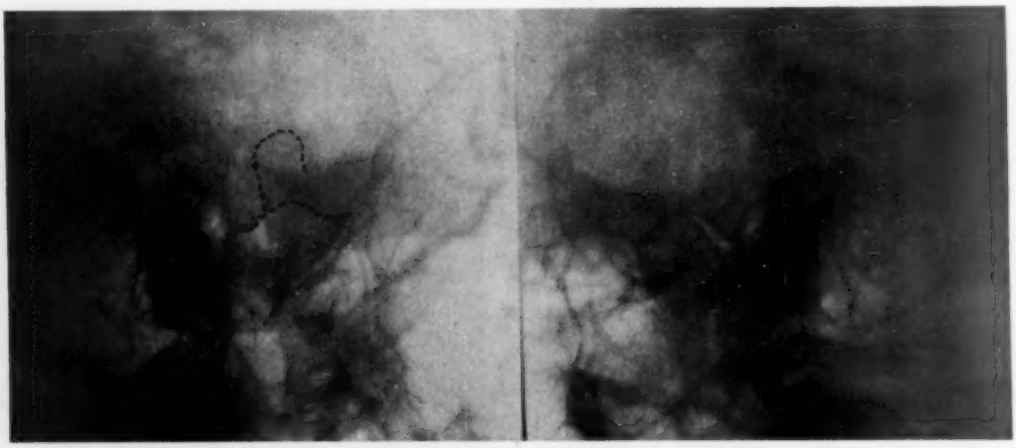

FIG. 4. Case III. Fracture of the neck of the left mandible with downward and outward dislocation of the right condyle.

CASE V. Patient G. P. The injuries in this case resulted from an automobile accident ten

years previous to admission. Roentgen examination of the right mandibular joint showed a fracture of the neck that had united with slight angular deformity, and an anterior dislocation of the condyle. On the left side

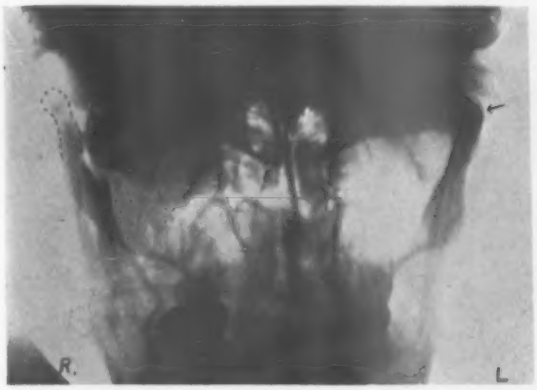

Fig. 5. Case III. Anteroposterior view of the same case as in Figure 4, showing outward angulation at the site of fracture on the left with downward and outward dislocation of the condyle on the right side.

(Fig. 7) there was a fracture just below the condyle without a dislocation of the head. This had united with overlapping, the proximal fragment being external. There was also an angular deformity pointing forward. There was marked excess callus formation, very densely ossified, filling the fossa and producing ankylosis of the joint. Another dense ossification in the petrous portion of the temporal bone on this side was also shown, undoubtedly the result of an injury in this region.

Dislocations and fractures of the neck also occur as complications of fractures of other portions of the mandible and, as such, they are perhaps too frequently overlooked because of the more striking deformity and symptomatology of the main fracture. Being but rarely shown in the routine roentgen examination of the mandible, they may not be suspected until later. Unfortunately this happened in two of the cases of this series. An associated fracture of the neck or dislocation of the condyle should always be suspected in severe injuries to the body of the mandible and its presence established or ruled out promptly since here, again, a satisfactory functional or cosmetic result cannot be obtained unless both conditions are considered and treated together.

Case VI. Patient A. G. This patient was injured in a street brawl. He was admitted to the hospital and a routine roentgen examination of the mandible showed a fracture at the symphysis. He was treated for this and was soon referred from the ward to the dental clinic for further treatment. The patient was very irregular in his visits to the clinic. Eleven weeks after his injury he was again sent to the roentgen-ray department, this time for examination of the mandibular joints. This showed a fracture of the neck with a dislocation of the condyle on the right side (Fig. 8). Attempts to reduce this by manipulation were unsuccessful. He was re-admitted to the ward but his general condition was such that operation was thought inadvisable. There is a poor functional result in this case which the patient ignores with his customary apathy.

Case VII. Patient M. D. This case does not

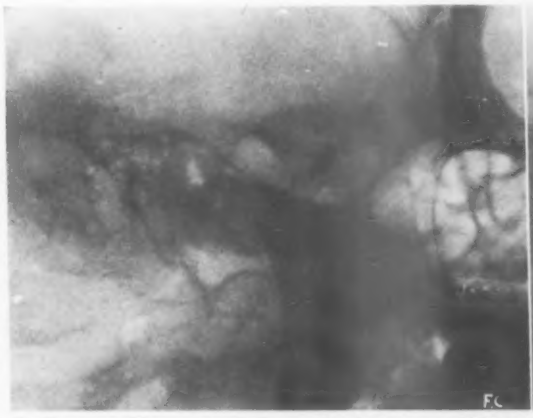

Fig. 6. Case IV. Fracture of the neck of the mandible with dislocation of the condyle.

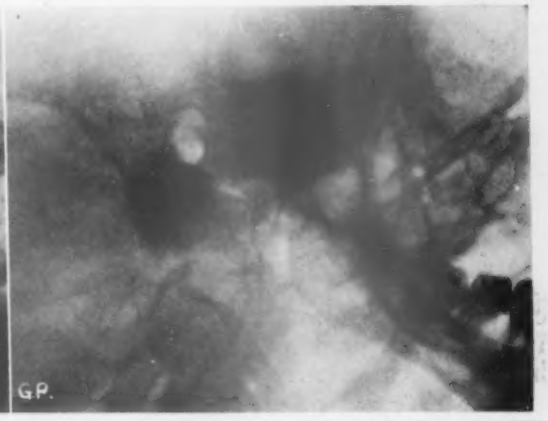

Fig. 7. Case V. Old fracture of the neck of the mandible with dense bony ankylosis.

belong under the heading of fractures but it seems advisable to present it along with the previous case since here, too, the injury to the joint was overlooked for a time, due to the severity of the main fracture. The patient was injured in an automobile accident. A routine examination of the mandible was requested and the films were made under difficulties. A very apparent fracture at the symphysis with marked displacement was shown. It was not until the acute symptoms of this fracture subsided that the injury to the joint was suspected. A roentgen examination of this region showed an anterior dislocation of the condyle (Fig. 9).

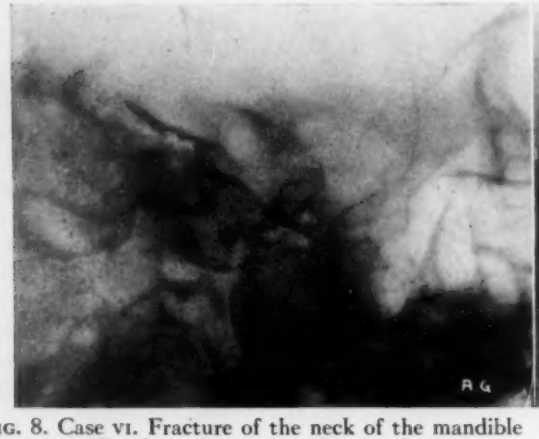

FIG. 8. Case VI. Fracture of the neck of the mandible complicating a fracture at the symphysis.

FIG. 9. Case VII. Anterior dislocation of the condyle complicating a fracture at the symphysis.

CHRONIC NON-TRAUMATIC CONDITIONS

Of abnormal conditions other than the traumas, I shall mention only those that seem of direct interest to us as roentgenologists, confining myself entirely to the discussion of cases that we have had.

Ankylosis. This condition is not so frequent as acute injuries, but it presents an important and interesting problem when it does occur. Henderson[6] in a series of 15 cases on which he operated, found that the process was fibrous in 6 and bony in 9. He did not give the roentgen findings in the series. Osgood[10] states that the process is usually fibrous and seems to assume that the condition is consequently of little interest to the roentgenologist. Two of the previously presented cases of this paper are of interest here: Case IV (Fig. 6) who was found at operation to have a beginning ankylosis which was still fibrous and of course not visualized in the roentgenograms, and Case V (Fig. 7) with a disability of ten years' duration. In the latter case the ankylosis was produced by a bone deposit so dense that at operation two chisels were broken in removing it. This condition is plainly visualized in the films. Between the extremes presented by these two cases there must lie the majority of the cases of bony ankylosis and it is only by the roentgen-ray evidence of the presence or absence of bone salt deposit in these structures that the surgeon may bring the case to operation forewarned as to the type of tissue he is to encounter.

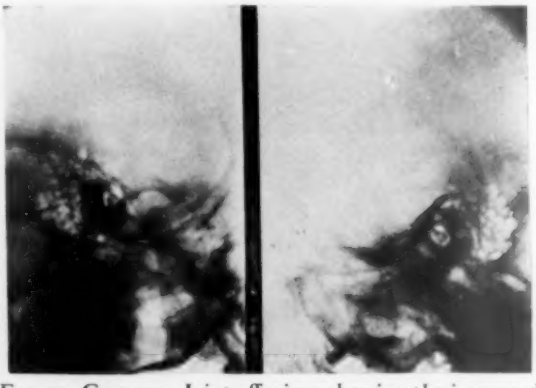

FIG. 10. Case VIII. Joint effusion; showing the increased width of the involved left side as compared with the normal right side.

Joint Effusion. Chronic irritation may cause changes in the soft structures here as in other joints and bursae, with resulting

effusion into one or both of the joint cavities. The complicated series of movements to which the joint is subjected, the hinge and gliding motions of the two sides in unison when the mouth is opened, the alternating use of these motions by the two sides to produce the grinding motions of mastication, and the tremendous power that is exerted by the muscles of the jaw, all would seem to be conducive to such joint changes.

FIG. 11*a*. Case IX. Complete destruction of the glenoid fossa and the condyle, with widespread involvement of the skull, from an overlying skin epithelioma.

FIG. 11*b*. The uninvolved side of the same case for comparison.

CASE VIII. Patient M. McN. was sent to us for examination, complaining of pain in the region of the left mandibular joint and of difficulty in opening the mouth. The onset was gradual and there was no history of injury. Noticeable swelling was present over the joint area without external signs of infection. Roentgenograms (Fig. 10) showed a definite increase in the joint space on the involved side as compared with the other but there was no evidence of bone change. Our feeling was that this was a case of an effusion into the joint. We were unable to follow the case further.

Infections. Several cases of osteomyelitis of the mandible in which the infection had spread up into the neck were examined but no changes in the joint were found other than bone salt absorption in the condyle.

Malignancy. Malignant involvement has been found in one case, L. B. (Case IX). This was the result of extension of a large ulcerating epithelioma which involved the whole of the temporal and parotid regions, as well as a portion of the parietal. The external ear had been destroyed. Roentgenograms (Fig. 11*a* and 11*b*) showed involvement of the skull over an area almost coincident with the skin ulcer. This varied all the way from complete bone destruction to areas that had a moth eaten appearance or only a lace-like bone structure. The destructive process had extended inward, involving the sphenoid as well as the petrous portion of the temporal bone. In one area this extended even beyond the midline. We were unable to identify either the glenoid fossa or the condyle.

Snapping Joint. We have thus far consistently failed to demonstrate any characteristic changes in that frequent and annoying condition called "snapping joint." One case, out of perhaps ten examined, showed on two occasions, six months intervening, a distinct difference in the size of the two condyles, the smaller being on the involved side. The joint space was correspondingly widened on this side. As yet the significance of these findings has not been determined.

ROENTGEN TECHNIQUE

Practically all of the roentgenograms of the mandibular joint that I have found reproduced have been taken in a modified and exaggerated lateral jaw position; that is, with the rays directed towards the joint from below the mandible of the opposite side. These seem rarely to show the joint

in a satisfactory manner. There is a distortion by lengthening of the shadows of the ramus, neck and condyle that seems more confusing than the foreshortening that is produced when the rays are directed from above.

Mayer[9] gives a technique in which the rays are directed through the face in a slightly oblique direction from the opposite side. His illustrations are not convincing and I have not been successful in reproducing his results.

Osgood[10] mentions the Law[8] mastoid position but in this mastoid technique the rays are directed too far posterior and too nearly vertical to show the joint clearly. The dense bony structures of the middle and internal ear, with those of the base of the middle fossa, overshadow the joint and almost obliterate it.

Kern[7] describes a complete roentgen-ray study of the skull in which a double oblique lateral view of the skull is used. He enumerates the structures visualized in this position, including the mandibular joint.

The roentgenograms of the cases presented in this study were made in the following manner. The side of the head to be examined is placed over a cassette tunnel holding an 8″ × 10″ screened film. The head is placed so that the sagittal plane of the skull is parallel to the film, the interpupillary line perpendicular to the film, and the line between the glabella and the upper lip parallel to the edge of the film. This is the position recommended by Granger[5] in his mastoid technique and his mastoid localizer can be used with advantage in this examination also.

The tube, at a film target distance of 24 in., is centered over the uppermost joint since, with the head in this position, the joint to be examined is directly below it. The tube is then shifted towards the top of the head a distance of 9 in. and tilted 30° downward toward the joint. A small cone should be used to lessen secondary radiation. For the second exposure of the stereoscopic pair the tube is shifted in the direction the patient is facing and tilted 8° towards the joint. The exposure factors are the same as for mastoid work except that the time is increased 50 to 75 per cent.

Our present method is to make double stereoscopic exposures of both sides on two 8″ × 10″ films. This permits simultaneous stereoscopic study of the two sides for comparison. A description of the apparatus with the technique of the exposure sequences has already been published.[1]

Anteroposterior views have been found to be of great assistance in some of the cases of multiple injuries (Fig. 5). These are best made with the patient's forehead resting on the film, the tip of the nose being just in contact with it. The tube should be accurately centered over the mid-sagittal plane of the skull at a 30 in. distance. The tube should be tilted so that the central ray passes through the head in the plane of a line drawn from just below the mastoid tips through the mandibular joints.

SUMMARY

(1) There is a need for better roentgenographic studies of the temporomandibular joint.

(2) A review is made of abnormal conditions of this region for which roentgenographic examinations are essential.

(3) A roentgenographic technique is presented.

(4) By this method reduplication of results is possible. The roentgenograms reproduced here are those of successive cases with positive findings.

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THE VISUALIZED ESOPHAGUS IN THE DIAGNOSIS OF DISEASES OF THE HEART AND AORTA*

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MINNEAPOLIS, MINNESOTA

INTRODUCTION

THE close anatomical relation of the esophagus to the heart and aorta has long been known and taken advantage of by clinicians. Percussion of the posterior wall of the heart and auscultation of the left auricle by means of tubes and tambours in the esophagus have been practised for some twenty-five years.[7] The esophagus responds readily to external influences; roentgen examination may disclose secondary changes due to various pathological states in the mediastinum. None of these are of more importance nor are more readily demonstrable than the changes produced in the esophagus by diseases of the heart and aorta. It is therefore surprising that in the mass of literature which has arisen about the roentgen diagnosis of cardiac and aortic disease, so little attention has been paid to this important diagnostic aid. Save for a brief mention of it by Steel[15] and a casual reference here and there, the American literature contains no material on this subject. Standard reference books on roentgen diagnosis such as those by Holmes and Ruggles[8] and by Christie[3] do not mention it at all. Vaquez and Bordet[17] pay no attention to this method and Assmann[1] gives it scant notice. A notable exception is Schittenhelm's "Roentgen Diagnosis" in which Schwarz[14] discusses the subject in some detail in the section on the esophagus; at the same time Groedel[6] ignores it completely in the section on cardiac diagnosis.

Although Holzknecht, as far back as 1901, called attention to the oblique positions and the retrocardiac space in the roentgen examination of the heart and aorta, no particular notice was given to the roentgenologic importance of the association of the esophagus with these organs until Stoerk[16] published his anatomical studies in 1909. Kovács and Stoerk[9] realized the clinical importance of this relation and demonstrated the marked changes which might take place in the position and size of the esophagus as a result of enlargement of the left auricle. Gäbert[5] in 1924 detailed these changes and again emphasized their importance in the roentgen diagnosis of mitral disease.

In 1920, Kreuzfuchs[10] demonstrated the close anatomical relation of the esophagus to the arch of the aorta and described a new method of measuring the arch, using the barium-filled esophagus to determine the right border.

Laurell,[11] Rösler[12] and many other European roentgenologists are using the barium-filled esophagus as an aid in the diagnosis of diseases of the heart and aorta with striking success.

The roentgenologic method is simple. A very thick barium sulphate paste is used which the patient holds in the mouth, swallowing it only when all preparations for the examination have been made. Roentgenoscopic examination is made in the posteroanterior, right and left oblique, and right lateral positions. Films are also made in these positions a moment or two after the barium paste is swallowed. It is best to have the patient inspire moderately. For demonstration of the

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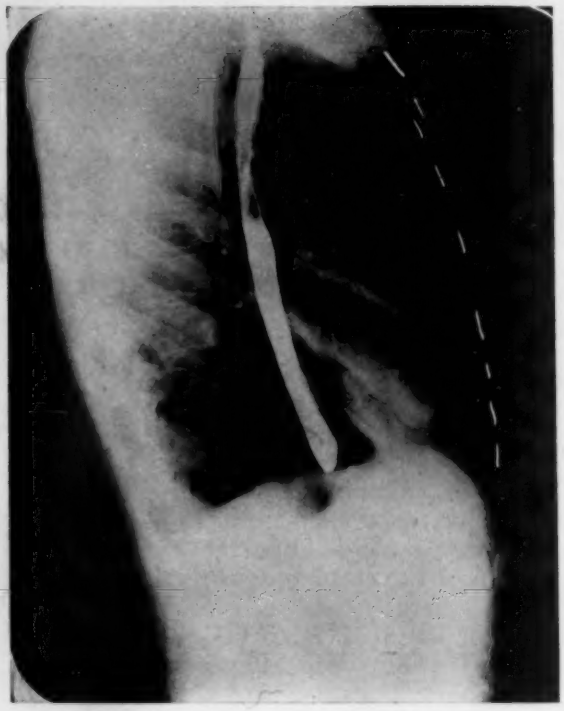

Fig. 1. Roentgenogram of the barium-filled esophagus in the right lateral position showing the normal relations. Note particularly the close apposition of the esophagus to the posterior wall of the heart and the distance between the posterior wall of the esophagus and the spine. The anterior chest wall is outlined.

enlargement of the left auricle, the posteroanterior, right oblique, and right lateral positions are used. For measurement of the arch the ordinary teleroentgenographic method and the right oblique position are used. For study of the descending aorta, the posteroanterior, left oblique and right lateral positions are utilized.

NORMAL ANATOMY

The esophagus passes through the thorax as a fairly straight tube, conforming somewhat to the posterior curvature of the thoracic spine. It lies anterior to the vertebral bodies throughout its extent, maintaining a distance of 1 to 3 cm. between its posterior wall and the anterior surface of the spine.

Viewed from the right side (Fig. 1), the esophagus is seen to almost bisect the chest. In its upper third the anterior wall is impinged upon by the arch of the aorta which normally produces a distinct constriction. Below this compression there is a shallower indentation produced by the pulmonary vessels and the large bronchi. From this point for a distance of 5 to 6 cm. down to a point 2 to 3 cm. above the diaphragm, the anterior wall of the esophagus is in close contact with the left auricle,

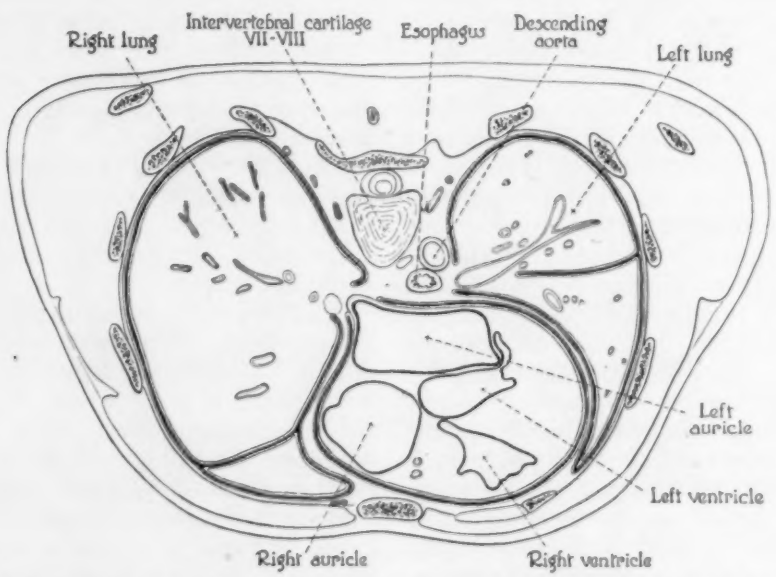

Fig. 2. From a dissection by Dr. Harry Hillstrom. Cross-section of the thorax at the level of the 7th dorsal vertebra. The esophagus is shown lying posterior to the left auricle which occupies most of the posterior surface of the heart. The descending aorta is also seen lying posterior and to the left of the esophagus. Note the space between the spine and the esophagus.

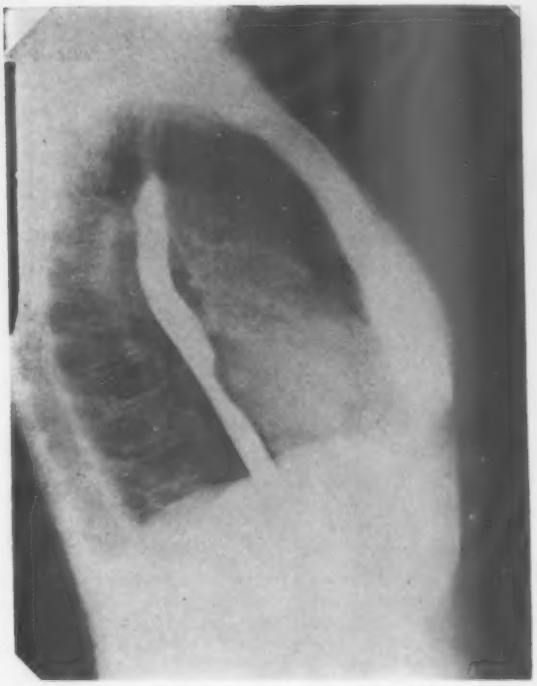

Fig. 3. Roentgenogram of the barium-filled esophagus in the right lateral position, showing clearly the shadow of the arch of the aorta and the esophagus crossing it. Note the indentation on the anterior surface of the esophagus caused by the arch of the aorta and the indentation below from the pulmonary vessels and the bronchi. From this point the esophagus can be seen in close relation to the posterior wall of the heart. The upper portion of the descending aorta is shown and its position posterior to the esophagus and in close relation to it can be clearly seen.

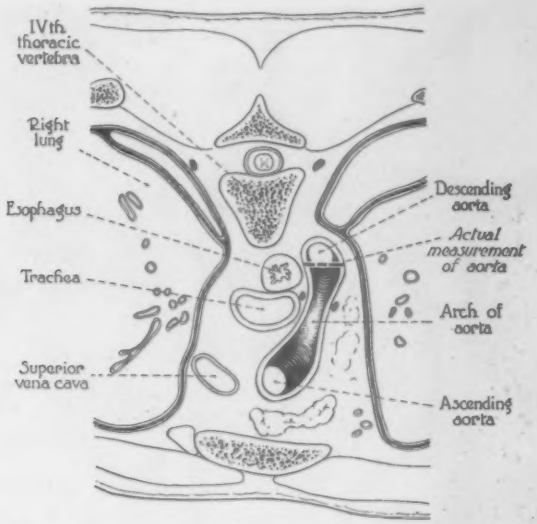

Fig. 4. From a dissection by Dr. Harry Hillstrom. Cross-section of the thorax at the level of the 4th dorsal vertebra. The arch of the aorta including its anterior and posterior portions is shown. The close relation of the esophagus to the descending portion of the arch is demonstrated. The broken line indicates the point at which the measurement of the arch is made. Note the lack of contact between the ascending portion of the arch and the esophagus.

which lies on the posterior surface of the heart. This can be clearly shown in anatomical cross-sections of the thorax as illustrated in Figure 2. The remainder of the thoracic esophagus is in contact on its anterior surface with a small portion of the left ventricle. It curves anteriorly just above the diaphragm to enter the hiatus.

Throughout its course the posterior wall of the esophagus is in partial contact with the descending aorta which lies anterior to and somewhat to the left of the spine and posterior and somewhat to the left of the esophagus. This relation is also shown in Figures 2 and 3. Viewed from the front, the esophagus can be seen to pass through the center of the thorax exactly in the midline. It crosses the arch of the aorta where the ascending portion enters into the transverse portion and here shows a marked indentation, well-termed by Kreuzfuchs the "bed of the aorta." Thus the esophagus forms the right border of the transverse and descending portions of the arch. This association with the arch is shown in Figures 4, 5 and 6. It follows the descending aorta closely throughout its extent, remaining to the right of it until a point just above the diaphragm is reached where the esophagus crosses the aorta to pass sharply to the left (Figs. 5 and 6).

On roentgen examination after the ingestion of barium paste, all of these normal relations can be accurately delineated as shown in Figures 1, 3 and 6.

ESOPHAGEAL CHANGES WITH MITRAL DISEASE

The left auricle is the first chamber of the heart to enlarge from disease of the mitral valve and in extreme cases it may become enormous.[2] No case of mitral valvular disease of any importance exists without some degree of dilatation of the left auricle and, in the absence of a general cardiac enlargement, the demonstration of

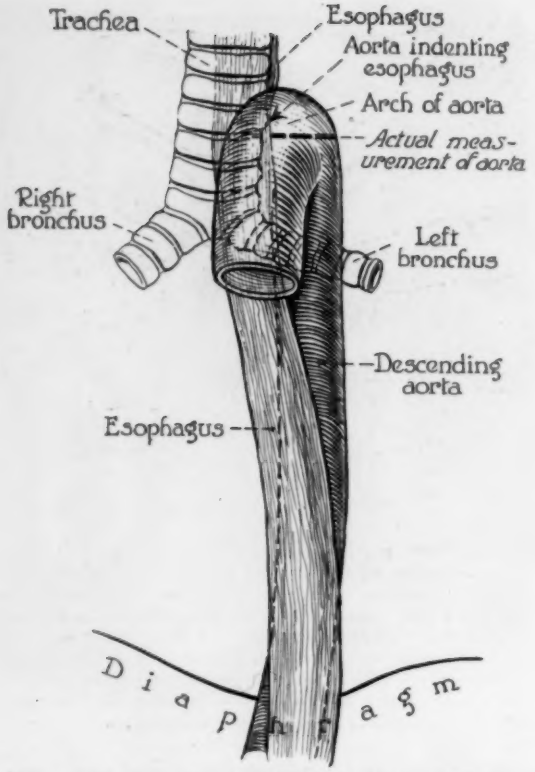

Fig. 5. From a dissection by Dr. Harry Hillstrom. Coronal-section of the thorax showing the close relation of the esophagus to the arch of the aorta and to the descending aorta. Note the esophagus crossing the arch and receiving a definite indentation on its left border. The descending aorta is shown to lie posterior and to the left of the esophagus, crossing to the right of it just above the diaphragm.

an enlarged left auricle is practically diagnostic. With general myocardial dilatation the left auricle will also enlarge, but these cases are usually obvious.

A marked convexity of the left border of the heart, that is, a median convexity on the left border due to dilatation of the conus pulmonalis, has been generally considered as the most important roentgen sign of a pathological mitral valve. It has been repeatedly demonstrated, however, that many normal individuals may show this median left convexity. This is particularly true of the asthenic type of individual who often complains of breathlessness and may occasionally have a systolic murmur which is actually functional in origin. Given this combination, a false diagnosis of mitral stenosis is not infrequently made. If, in these cases,

Fig. 6. Roentgenogram of the barium-filled esophagus in the posteroanterior position showing the same relations as are diagrammatically represented in Figures 4 and 5. The esophagus and the arch of the aorta are outlined.

dilatation of the left auricle cannot be demonstrated, the diagnosis of mitral stenosis should never be made.

Likewise, congenital defects such as a patent ductus arteriosus, or right heart dilatations from chronic pulmonary disease, may present a teleroentgenogram, or even a clinical picture which is often confused with mitral disease. The demonstration of a lack of enlargement of the left auricle may be of great aid in ruling out mitral disease and indicates that the heart is enlarged only on the right side.

Numerous other cases illustrate the importance of determining enlargement of the left auricle. For example, in a case of cardiac enlargement from aortic valvular disease, the clinical signs of tricuspid regurgitation may appear. The question as to whether this is a new organic lesion of the valve, or simply a relative insufficiency due to dilatation of the right ventricle often arises. If enlargement of the left auricle is absent it would indicate that there is no general cardiac enlargement and that the tricuspid insufficiency is more likely to be organic in origin. The demonstration of an enlarged left auricle would tend to indicate the reverse.

It is obvious, therefore, that the roentgen

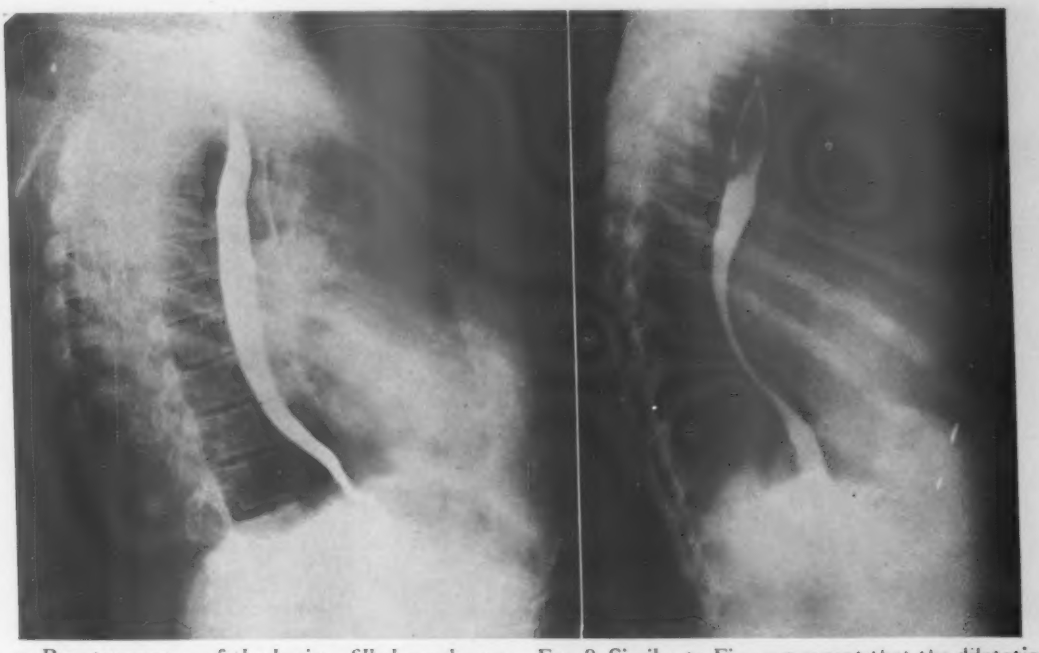

Fig. 7. Roentgenogram of the barium-filled esophagus in the right oblique position in a case of mitral disease of moderate degree. Note the posterior displacement of the esophagus from the 5th to the 9th dorsal vertebrae due to the enlarged left auricle. Note especially the obliteration of the postesophageal space which is present in the normal (Figs. 1 and 3).

Fig. 8. Similar to Figure 7 except that the dilatation of the left auricle is more extreme so that the posterior displacement of the esophagus is more marked and there is, in addition, distinct compression of this portion of the esophagus. The passage of the barium paste was markedly delayed.

demonstration of enlargement of the left auricle is of considerable importance in cardiac diagnosis. Occasionally, the left auricle can be seen in the right oblique view by the usual methods, but this visualization is inconstant and it is always difficult to be certain that it is the auricle which is being visualized.

With enlargement of the left auricle, the esophagus is always displaced posteriorly and occasionally to the right. In rare cases it is displaced to the left as shown by Rösler and Weiss.[13] The posterior displacement begins about 8 to 10 cm. above the diaphragm and may continue to a point about 2 cm. above the diaphragm unless the auricle is exceedingly large when it will be displaced even lower. The space between the esophagus and the spine is diminished or obliterated in this area and there is, in addition, a distinct compression and narrowing of the lumen of the esophagus. These findings can be easily made out in the right oblique or right lateral views as shown in Figures 7 and 8. It will be

Fig. 9. Posteroanterior roentgenogram of the esophagus showing the displacement to the right and the compression of the left border which may be produced with pronounced enlargements of the left auricle. The lateral thoracic walls and the left border of the heart are outlined.

Fig. 10. Posteroanterior roentgenogram in a case of aneurysm of the transverse and descending portions of the arch of the aorta. This shows the displacement of the esophagus to the right which may occur with enlargements of the arch and also how clearly the limits of the aneurysm can be delineated in this way. Smaller enlargements of the arch can similarly be made out. The close association of the esophagus with the descending aorta is also shown.

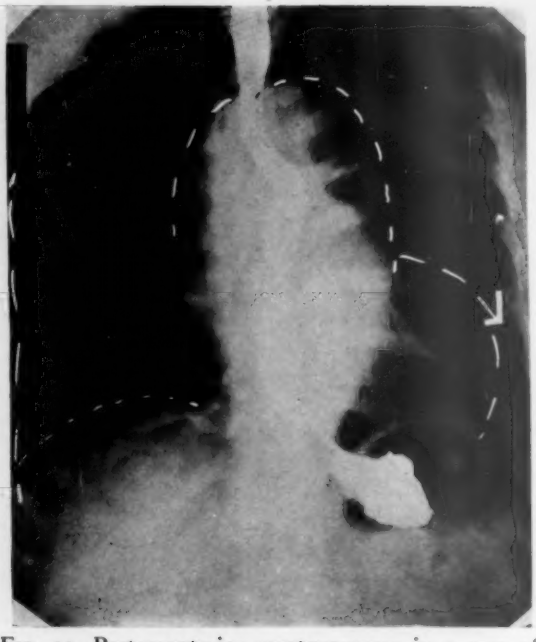

Fig. 11. Posteroanterior roentgenogram in a case of diffuse dilatation of the aorta showing the pronounced indentation of the left border of the esophagus by the dilated arch, the tortuosity of the esophagus as it follows the lengthened descending aorta, and the indentation of the left border by the dilated descending aorta, which is clearly shown. The right chest wall, the right diaphragm, the left border of the heart, and a portion of the aorta are outlined.

found that the passage of the opaque mixture through the esophagus may take five to eight minutes when there is marked enlargement of the left auricle. The striking compression which is present in severe cases can be demonstrated by having the patient swallow a large capsule of barium sulphate. The capsule will stop at the upper surface of the auricle and may remain there for ten or fifteen minutes.

Although marked dilatations of the left auricle can be easily seen, slight changes may be difficult to make out. It is important to avoid making films or doing roentgenoscopy during expiration as this tends to produce some slight posterior curving of the esophagus. It must also be noted that marked curvatures and distortions of the vertebral column may produce corresponding changes in the esophagus and this must be ruled out as a factor. Careful attention to the space between the esophagus and spine will usually determine whether or not there is any real displacement due to enlargement of the auricle.

The displacement to the right can be seen in the posteroanterior view as shown in Figure 9. There is a definite indentation of the left border of the esophagus and a tendency for it to superimpose upon the right border of the spine which normally remains exposed.

ESOPHAGEAL CHANGES WITH DISEASE OF THE AORTIC ARCH

Because of inability to determine the exact location of the right border, accurate measurement of the arch of the aorta has always been difficult. The shadows of the superior vena cava and other structures in this region often produce confusion as Fossier[4] has indicated. By the method of Kreuzfuchs[10] the barium-filled esophagus, as it crosses the arch of the aorta, is used to give a constant point for the right

Fig. 12. Left oblique roentgenogram in a case of diffusely dilated and lengthened aorta showing the marked tortuosity of the esophagus and how closely it accompanies the aorta throughout its course. Note especially the pulling up of the esophagus just below the arch which is also shown in the posteroanterior view. This tortuosity may appear in cases of senile arteriosclerosis and hypertension as well as in luetic aortitis.

Fig. 13. Roentgenogram in the right lateral view in a case of massive aneurysm of the aorta in its descending portion. The esophagus is displaced anteriorly under these conditions so that the postesophageal space is greatly increased in contrast to the decrease which occurs with mitral disease. The anterior chest wall is outlined.

border. This is well illustrated diagrammatically in Figure 4 and in the roentgenogram in Figure 6. The measurement of the transverse diameter should be made from the left border of the esophagus to the left border of the arch on the teleroentgenogram or orthodiagraphic tracing. It is found to be from 2.0 to 3.5 cm. in the normal. It must be borne in mind, however, that by this method the ascending portion of the arch is not included in the measurement. Furthermore, changes in the ascending aorta do not affect the esophagus appreciably.

Enlargements of the arch of the aorta can be easily determined by this method: (1) by the actual increase in the transverse measurement as given above; (2) by a marked increase in the indentation which is normally present in the left border of the esophagus, and (3) by distinct displacement of this segment of the esophagus to the right. All of these findings are well shown in the case of an aneurysm of the arch illustrated in Figure 10.

Likewise in the right lateral position, posterior enlargement of the arch can be made out by the posterior displacement and increased compression of the esophagus at the point where it crosses the aorta. The increased anteroposterior diameter of the arch can also be better visualized in this way.

ESOPHAGEAL CHANGES WITH DISEASE OF DESCENDING AORTA

The esophagus is closely attached to the descending aorta and tends to follow its course throughout the thorax. When filled with an opaque mixture, the esophagus, on roentgen examination, will clearly delineate the anterior and right borders of the descending aorta.

Tortuosity and lengthening of the aorta, accordingly, produce tortuosity and distortion of the esophagus, and rather bizarre appearances may be produced

even in simple cases of arteriosclerosis or hypertension. If dilatation is combined with the tortuosity the findings are even more striking. In the typical case, the posteroanterior view will reveal the proximal segment of the esophagus displaced to the right where it crosses the arch of the aorta. Directly below this point there will be a sharp angulation, the esophagus being pulled up to the left. From this point down to the diaphragm the esophagus may run fairly straight or may show a marked concavity on its left border, a marked convexity on its right border. These findings are well illustrated in Figure 11 where there is dilatation as well as lengthening of the whole aorta.

In the left oblique position, the distortion of the esophagus is even more marked, numerous angles and curves being present within it; all of them, however, corresponding closely to similar curves and angles in the course of the descending aorta. Such a case is shown in Figure 12.

Dilatations of the descending aorta, whether diffuse or aneurysmal, tend to produce obvious displacements of the esophagus. Furthermore, the barium-filled esophagus helps to delineate more clearly these dilatations, especially in the posteroanterior view, because it makes visible the medial border of the aorta which is otherwise lost in the shadows of the spine and heart. An aneurysm in the upper three-fourths of the aorta tends to displace the esophagus anteriorly as shown in the right lateral view. This displacement is well shown in Figure 13 where the space between the posterior wall of the esophagus and the spine is increased to three times its normal diameter by a large aneurysm involving most of the descending aorta. In the posteroanterior view, the displacement to the right may be seen. If the aneurysm is in the distal one-fourth of the aorta, anterior displacement is also shown in the lateral view, but in the posteroanterior view, the displacement may be to the left. Schwarz[14] has reported a case wherein two aneurysms were present, one in the arch displacing the esophagus to the right, and another above the diaphragm displacing it to the left.

In this region just above the diaphragm, the clinical diagnosis of aneurysms is exceedingly uncertain. In the usual roentgen examination, difficulties also exist, as this distal portion of the descending aorta is hidden by the shadow of the heart. Displacement of the esophagus in this region is therefore of great importance and should be looked for. An aneurysm, otherwise not demonstrable, may be visualized in this way.

CONCLUSIONS

1. The roentgen diagnosis of diseases of the heart and aorta can be greatly aided by an examination of the barium-filled esophagus.

2. Dilatation of the left auricle is an early and fairly positive sign of mitral disease and its absence makes a diagnosis of mitral disease very doubtful.

3. Dilatation of the left auricle may be clearly demonstrated or its absence proved by examination of the esophagus which is displaced posteriorly and compressed when the left auricle is enlarged. It may also be displaced to the right, rarely to the left.

4. Using the esophagus as the right border, a more accurate transverse measurement of the transverse and descending portions of the arch of the aorta may be made.

5. Dilatations of the arch will produce deviation to the right and posteriorly, and compression of the esophagus. The actual size of an aneurysm may be clearly delineated.

6. Tortuosity and lengthening of the descending aorta such as occur with arteriosclerosis and hypertension, can be graphically demonstrated by distortion of the esophagus which accompanies the aorta in its course.

7. Dilatations, either local or general, of the descending aorta produce anterior displacement and compression of the esophagus. If the dilatation or aneurysm is in the proximal three-fourths, there may also be displacement to the right; if in the distal one-fourth there may be displacement to the left.

8. This secondary change in the esophagus is a very important aid in the diagnosis of aneurysms directly above the diaphragm.

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LOBAR AND CENTRAL PNEUMONIAS IN CHILDREN*

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THE word "pneumonia" in this article is used for the acute or subacute fibrinous exudative inflammations, and not for pneumonitis in general. In the study of pneumonia, however, it is well to remember that we are dealing with one of the many types of pulmonary inflammation in which certain early phases are not differentiable roentgenographically, at least in children. In all inflammations of the lung the primary physical reaction is congestion, or engorgement of capillaries. This may be limited to a small area or it may appear almost simultaneously over a large area and in either case it may extend or remain limited. The successive changes of infiltration of extracapillary tissues and, in pneumonia, of exudation into the air sacs manifest themselves on the roentgenogram by increase of density. Theoretically, these stages should be differentiated by the roentgenologist, and it has been my experience that the congestive stage may often be determined and differentiated from the exudative state.

As to "lobar," croupous or fibrinous pneumonia, pathologists seem agreed that while this ultimate result of filled air sacs is a specific change for the pneumococcus and that that germ is responsible for consolidation in the great majority of cases, there are others, with an identical physical change in the lung which may be caused by any of a variety of organisms such as the staphylococcus, streptococcus, Friedländer bacillus, typhoid bacillus, influenza bacillus, and colon bacillus. This same list of organisms is given in somewhat the same proportion for lobar pneumonia and for lobular pneumonia.[1,3,7]

It is conceivable that lobular infections, causing the clinical extended bronchopneumonia, with clearing in one locality and beginning in another could be explained by the aspiration of infective material into uninvolved areas from already infected areas.

An initial massive infection might be drawn into a bronchial stem supplying one lobe and result in complete lobar pathology without involvement of another lobe. Here again re-aspiration might cause either a secondary involvement of another lobe in its entirety, or cause lobular involvement

* Read at the Twenty-ninth Annual Meeting, American Roentgen Ray Society, Kansas City, Mo., Sept. 25–28, 1928.

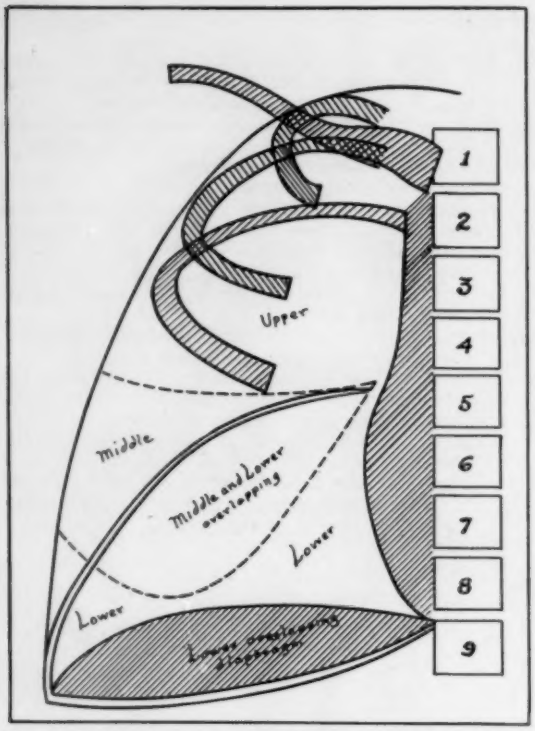

FIG. 1. Diagram representing posteroanterior projection of right lung as ordinarily seen in the small child. The middle lobe varies somewhat in different individuals. The upper lobe shadow is limited below by a more or less transverse line at the level of the fifth dorsal vertebra and covers three ribs anteriorly. The middle lobe is in contact with the chest wall anteriorly and laterally between the broken lines. The lower lobe is outlined by the double lines. The curve of the outer border sometimes begins higher and extends more towards the lateral chest wall.

elsewhere. A fair proportion of the lobar cases studied in children do show lobular pneumonia on the opposite side or in another lobe on the same side.

Now the bacteria mentioned as causing these two clinical diseases comprise a majority of the common forms of pathogenic organisms and if all of them always caused fibrinous pneumonia we would have none left to account for the lighter infections which cause the evanescent blushes so often encountered roentgenographically, nor for the lung abscesses. Yet these conditions do occur and we know they are of infectious origin. We must therefore consider some of these same bacteria as the causative agents in such cases.

The character of lung change from almost any common infective organism

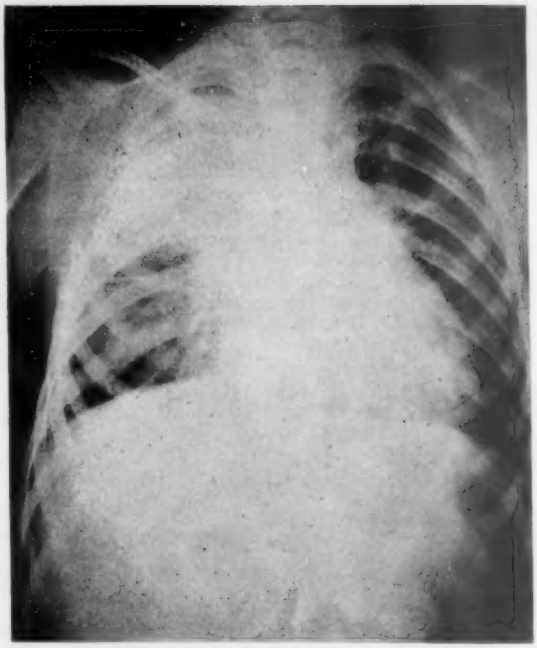

FIG. 2. Thickened interlobar pleura outlines the middle lobe below a pneumonic upper lobe. The lower lobe would probably show beneath the middle lobe with higher centering of target, and deeper inspiration. Note that with low centering the eighth dorsal vertebra is projected in line with the thickened upper-anterior pleural line, and the upper lobe "feathers off" below, which would not occur with a higher centering of the target. The entire density, however, is still confined to the area of three ribs anteriorly.

would then appear to depend, not altogether on the peculiarity of the germ, but also upon fortuitous factors as follows:*

1. Volume of the initial infection.
2. Distribution of the initial infection.
3. Subsequent distribution of re-infections.
4. Virulence of the type of organism.
5. Virulence of the particular strain.
6. Patient's state of resistance.

In studying 100 cases of lobar pneumonia in children, selected from a considerably larger number including many of doubtful diagnosis, I have charted the factors of age, sex, character of onset, febrile course, relapse, complications, blood count, clinical diagnosis, roentgenologic characteristics, lobes involved, recovery, improvement and death. Thrity-nine cases were left out of parts of the tabulation because of uncer-

* It is not the author's intention to dispute the accepted fact of the tendency for specific reactions to certain organisms, such as abscess for pus-producing germs, fibrinous exudate for the pneumococcus and others, but to try to show that lung inflammations in general have early stages that are at times not differentiable in children.

Fig. 3. Note the marked slant of right interlobar lines in a long-chested child.

sity conglomerate rather than homogeneous, and poor quality of roentgenograms. This was done in an attempt to reduce the tabulation to the narrow limits of the textbook picture of fibrinous pneumonia. Etiology was not proved frequently enough to provide reliable statistics, nor were physical findings clearly given often enough to prove of value in the study. I have found complications so frequent, atypical shadows so abundant, and confusing incidental shadows so bothersome in children's cases that an analytical study of this kind seems desirable.

Some of the observations and conclusions from this study are as follows:

TECHNIQUE

To obtain roentgenograms of children's chests of good diagnostic quality requires instantaneous exposure, with regulation of the voltage to the size of the infant or child and making the exposure at a definite phase of respiration, preferably inspiration. The use of too high a voltage will blot out the early shadows of initial inflammatory congestion.

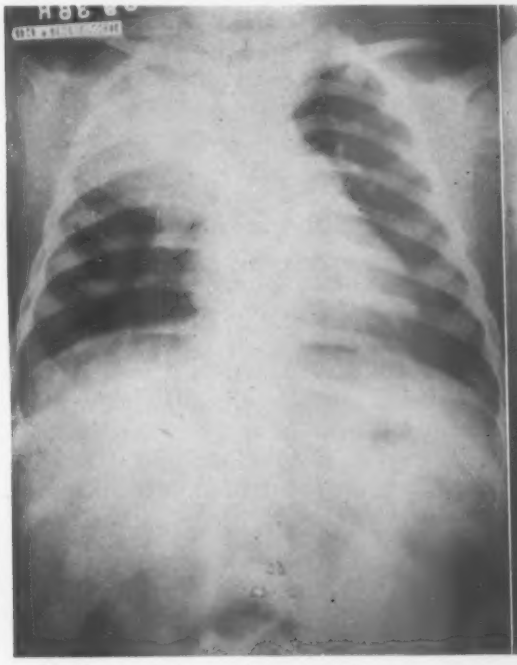

Fig. 4. Typical complete right upper lobar pneumonia.

Fig. 5. Same case as in Figure 4, lateral projection. Note level at fifth dorsal vertebra.

tain factors such as empyema masking the underlying lung condition, lobar den-

TOPOGRAPHY

Landmarks for consolidated upper lobes,

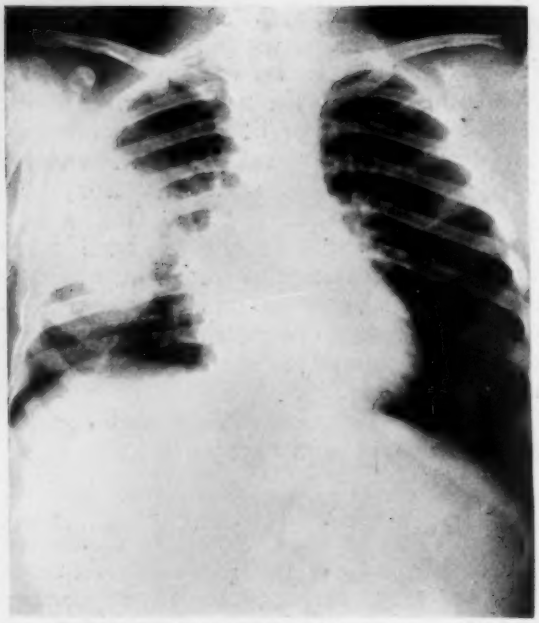

FIG. 6. Right middle lobe consolidation in a child aged six. Typical crisis one day before. Note lower border shades off almost to diaphragm and that lower lobe clear space shows internally and externally above the diaphragm.

FIG. 7. Same case as in Figure 6, lateral view. Nearly the lower third of the lower lobe is below the level of the peak of the diaphragm. The lower lobe presents a fairly horizontal upper border from the hilus backwards and would not "feather off" noticeably in a posteroanterior view.

for the most part, do not appreciably differ, even in infants, from those in adults. Growth of lungs and bony cage appears to progress without change in their relations. Nevertheless, demarcations are variable in individual cases and diagrams serve only as a basis for evaluation as do diagrams of a surgical operation.

I have found the right lower lobe in children as seen in the posteroanterior view to be somewhat different in outline and character from that commonly described for adults, it showing little or no shading off above and presenting a curved outline from the region of the hilus outward and downward to the chest wall.

I have found the right middle lobe to occupy a position sufficiently lateral to be uncovered, at least in part, by either upper or lower lobe in the posteroanterior projection, and that it is not entirely masked by a consolidated lower lobe as Sante[6] finds to be the case with adults.

Short-chested, deep-chested children show less slanting interlobar planes than long, shallow-chested ones.

The frequent lower position of the upper boundary of the consolidated middle and lower lobes and the higher position of the lower boundary of the consolidated right upper lobe, as frequently seen, suggest expansion pressure of the sound lobe upon the other, or some atelectasis of the consolidated lobe, or both.

When the right upper and middle lobes, (or the left upper lobe) are consolidated, deep inspiration, with lifting of the ribs and descent of the diaphragm, will allow the clear lower lobe to expand and show between the diaphragm and the consolidated lobe on the posteroanterior plate.

PROGRESSION AND CLEARING

Consolidation appeared to progress either from periphery inwards, from within outwards, from below upwards, or from above downwards, and to clear likewise, or to clear in patches. Cases, typically fibrinous penumonia clinically, were encountered which did not show the

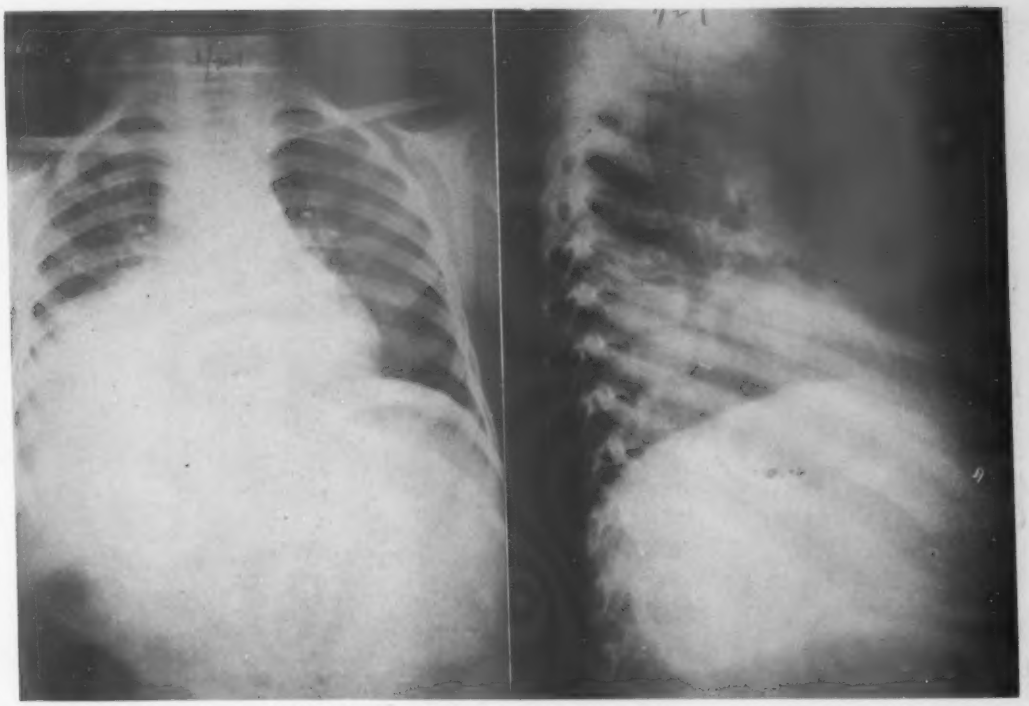

Fig. 8. Right lower lobe consolidation as usually seen in children (compare with diagram).

Fig. 9. Lateral view of same case as in Figure 8. Note the less acute slanting of interlobar plane in this deep-chested child. While this lobe is partially clear it is still definitely outlined.

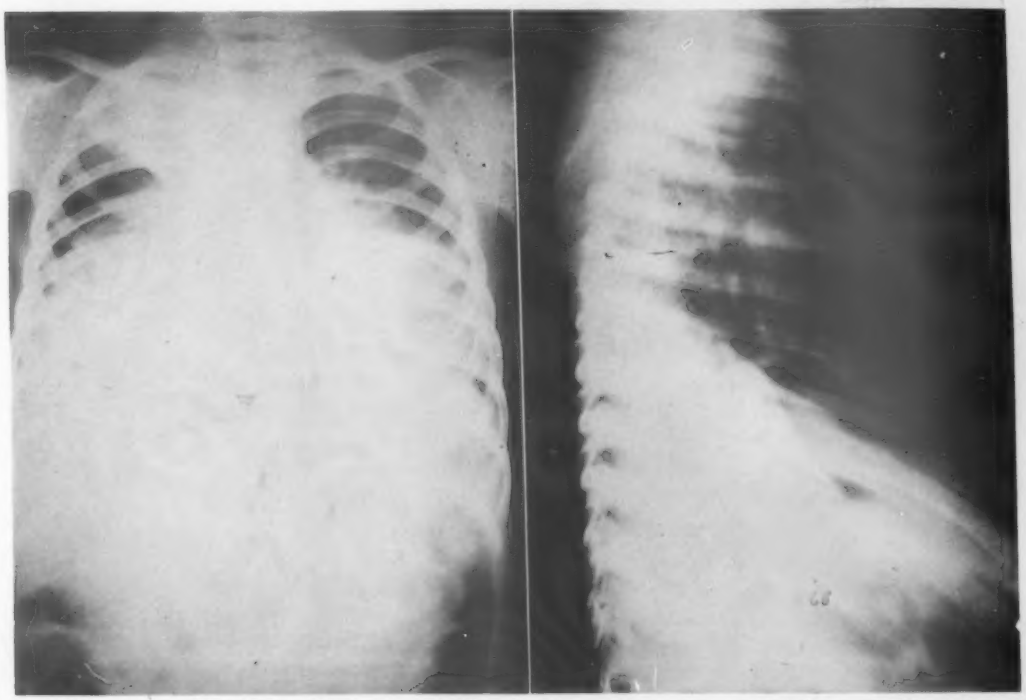

Fig. 10. Right upper and right lower lobe consolidation with right middle clear. This cut also illustrates typical *left* lower lobe consolidation. It is unusual to see the right middle lobe escape when the upper and lower are involved.

Fig. 11. Same case as in Figure 10. Note demarcation of both consolidated lower lobes.

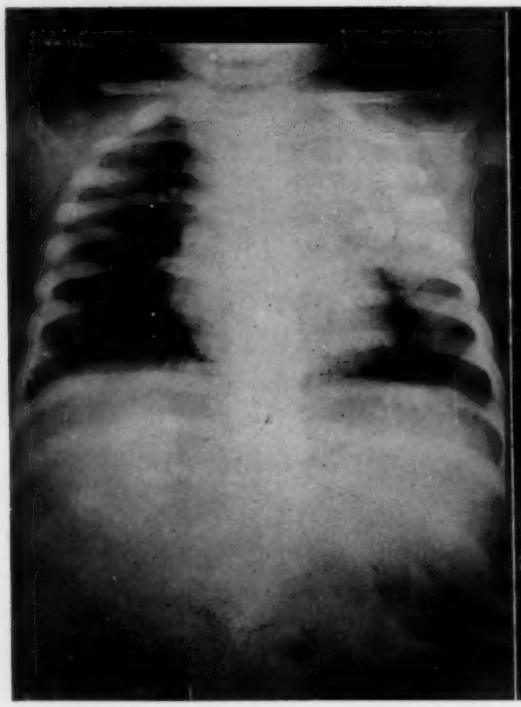

FIG. 12. Typical left upper lobe consolidation. This shades off nearer to the diaphragm than is shown in the reproduction.

FIG. 13. Lateral view of same case as in Figure 12. Lower border of upper lobe well defined.

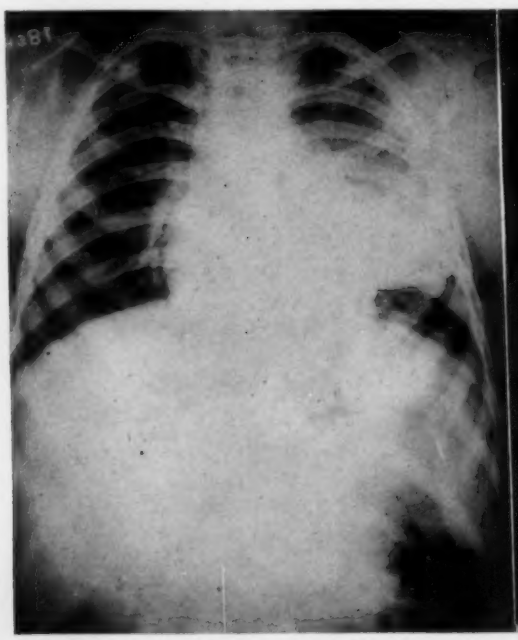

FIG. 14. Diagnosis in this case from this plate alone would be indefinite as between interlobar empyema, lung abscess or pneumonia. It is not clearly confined to either lobe (see Fig. 15).

FIG. 15. Lateral view of same case as in Figure 14. Density is located as being in upper part of lower lobe. This case had a sudden onset Feb. 3, was admitted Feb. 4, roentgen examination Feb. 5, had a crisis Feb. 6 and was discharged well four days later. I have seen a removed specimen of a left lower lobe which showed a cleavage line with apparently attempted lobe formation in this situation.

Fig. 16. An inflammatory area extending outward from left hilus which cleared without further extension and was accompanied by a definite crisis—hilar pneumonia.

Canelli,[2] that stereoscopic views will distinguish between complete consolidation and multiple densities in this triangular area is entirely impracticable for infants and younger children whose breathing cannot be controlled. The sign is valuable when present, but is by no means a constant finding.

DIFFERENTIATION AS TO ETIOLOGY

While recent investigations of others point to differences in lobar shadow characteristics which may indicate distinct etiology, I have been able in the small lung fields of infants and young children to differentiate only between complete lobar, conglomerate lobular, and, in some cases, clearing lobar pneumonia.

After the completion of this study, appeared the article of Kornblum[4] on roentgen-ray diagnosis of pulmonary infections with the Friedländer bacillus. A review of the plates used in this study does not reveal any cases with the requirements given by Kornblum; such cases were probably classed as bronchopneumonia and were not included. One case in this

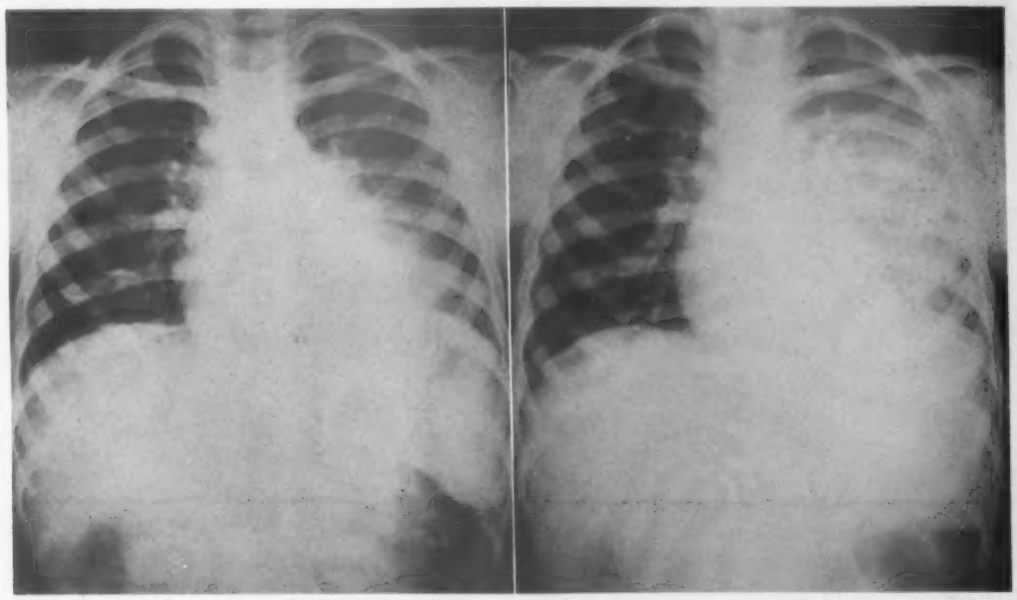

Fig. 17. Case similar in appearance to Figure 16.

Fig. 18. Same case as in Figure 17, three days later. Complete lower lobar pneumonia. Crisis four days following this examination. This with preceding and following cuts illustrates difficulties in prognosticating the outcome of inflammatory areas.

"triangle radiologique" of Weill and Mouriquand. Furthermore, the suggestion of Lemaire and Lestocquay, quoted by

series which showed abscesses at autopsy

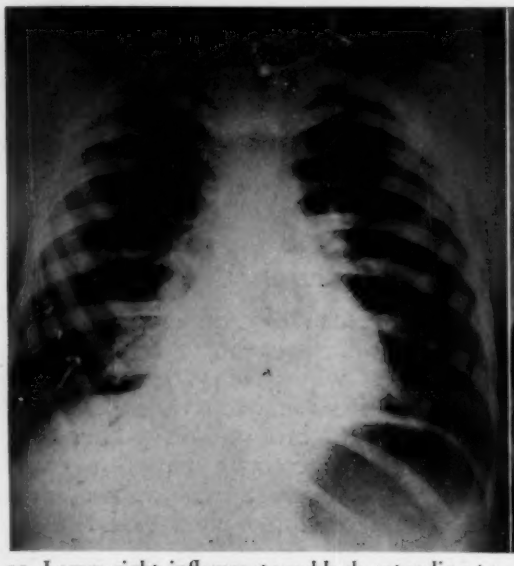

FIG. 19. Lower right inflammatory blush extending to arrows. This followed whooping cough.

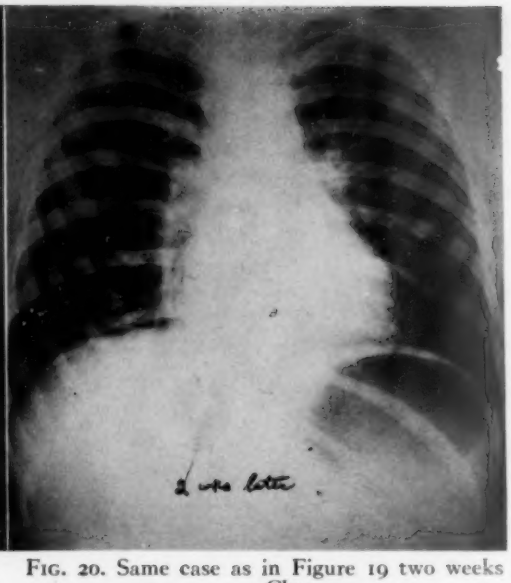

FIG. 20. Same case as in Figure 19 two weeks later. Clear.

gave a culture of *Streptococcus viridans*. The roentgen shadow was homogeneous. Some cases which were clinically influenza have given lobar shadows definitely homogeneous.

CENTRAL OR PARTIAL LOBE PNEUMONIA

The controversy as to the existence of "central" pneumonia seems today to be settled. Probably the terminology is at fault. If "central" pneumonia means origination in the center of a lobe, there would be none definitely proved in this series. If it means origin centrally in the chest, many cases appear to come in that class, beginning centrally at the hilus and extending into the parenchyma to varying distances without reaching the periphery. These are surely "central" as opposed to "peripheral."

On the theory of infection by aspiration, however, a small infective charge might conceivably lodge within a small bronchial branch centrally in the lung and set up an initial pneumonia there. The experiments of Blake and Cecil as quoted by Sante[5] appear to have covered only infections set up by planting germs in the trachea and thus do not exclude possible aspiration infection in a finer bronchus with the larger bronchi escaping, in which case the path of progress would be from a central point in the lung to the periphery.

Partial lobe consolidations, discrete, do occur.

The short course of some central cases leads to speculation as to whether many

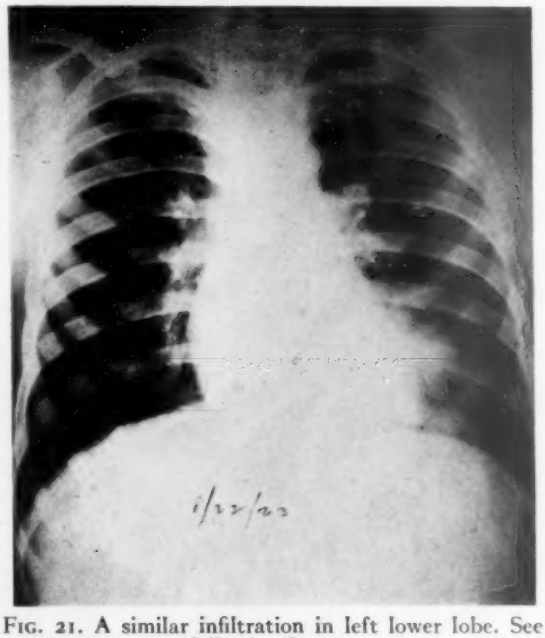

FIG. 21. A similar infiltration in left lower lobe. See following figures.

inflammatory blushes without evidence of exudate may represent abortive fibrinous pneumonia, beginning within the lobe.

That portion of the left upper lobe which

FIG. 22. Area has increased.

FIG. 23. Area greatly increased.

is the analogue of the right middle lobe may at times be alone consolidated.

ORDER OF LOBE INVOLVEMENT

The order of single lobe involvement is:

(*a*) 1. Right upper—28.5 per cent
equal
(*e*) Left lower—28.5 per cent
(*d*) 2. Left upper—25.0 per cent
(*b*) 3. Right middle—14.3 per cent
(*c*) 4. Right lower—least 3.7 per cent

Stengel gives:

1. Right lower—most.
2. Left lower—next in number.

When all combined lobe cases are included, the order is approximately:

(*a*) 1. Right upper—26 per cent
(*b*) 2. Right middle—25 per cent
(*c*) 3. Right lower—18 per cent
(*e*) 4. Left lower—16 per cent
(*d*) 5. Left upper—15 per cent

The letters, *a*, *b*, *c*, represent the right lobes from above down, *e* and *f* the left lobes from above down.

Ratio of single lobe to combined lobe cases, 4:5.

TEMPERATURE

The temperature course is so often uncharacteristic as not to be dependable for diagnosis. Several definite crisis cases, uncomplicated, had the septic type of fever, although with critical cessation. The crisis cases, however, had a generally high maximum excursion.

FIG. 24. Density seen to be posterior. Abscess, size of an orange, opened and drained, with recovery.

Of all cases, 35.6 per cent exhibited typical crisis.

Of crisis cases, 86 per cent were uncomplicated.

Of lysis cases, 24 per cent were charted as uncomplicated.

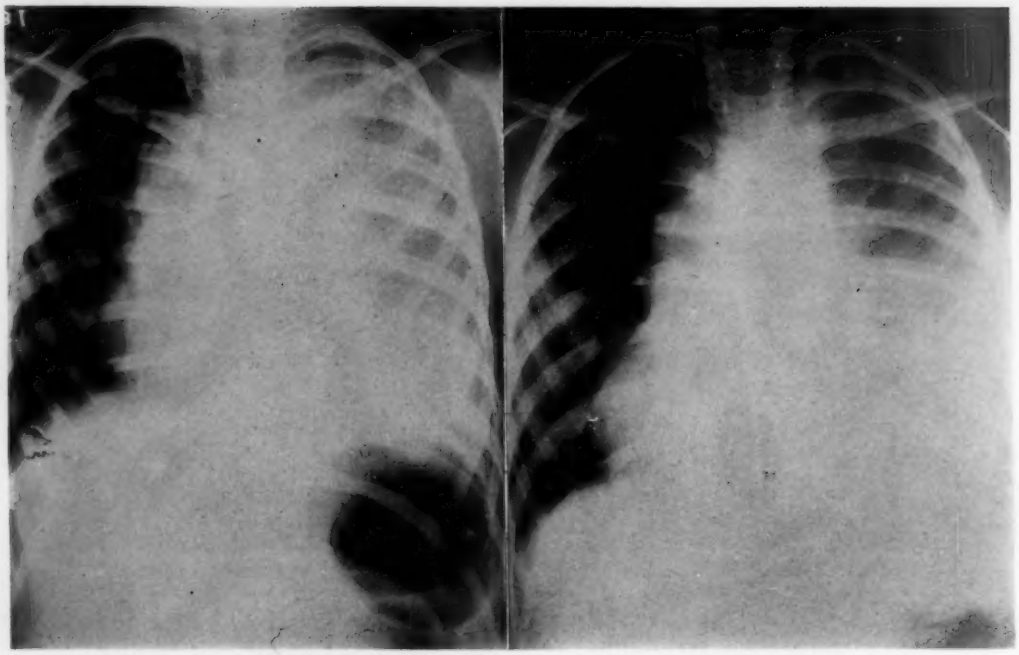

FIG. 25. This and Figure 26 show a differential point sometimes obtainable in children in determining underlying lung condition with pleural effusion present. The prone position above shows the usual classical signs of pleural fluid with displacement of mediastinal structures.

FIG. 26. Same case as in Figure 25 in erect position. Note that in the small child fluid settles so that a clear upper lobe can be fairly well determined. Plastic exudate is excluded by this sign. There is no air present in this case.

Of uncomplicated cases, crisis occurred in 75 per cent, lysis in 25 per cent.

In these lysis cases, complications such as otitis media may be unrecognized and a failure of crisis should therefore prompt diligent search for other trouble. Perhaps many of this 24 per cent really had some complication, unrecognized.

The extent of involvement, whether lobar, partial or hilar, does not determine as between crisis or lysis in fever, if the ruling out of complications in certain lysis cases is accurate.

COMPLICATIONS

Of all cases, 52.5 per cent had some complication (see also notes under "temperature").

Recognized complications were listed as:

Otitis	Measles
Empyema	Whooping cough
Mastoiditis	Chicken pox
Cardiac	Typhoid
Abdominal	Meningitis
Subpleural abscesses	Burns
Renal	Foreign body in nasopharynx
Tonsillitis	Encephalitis

with otitis far in the ascendancy, 30 per cent of all cases, and empyema second, 8 per cent of all cases.

No empyema was found in single upper lobe cases.

Practically, bronchopneumonia when present is not considered a complication, but a part of one pneumonic attack which has lobar extent in one place and lobular in another.

Mediastinitis or peritracheitis accompanies many cases of lobar pneumonia in children.

DURATION

Duration from onset to crisis averaged 7.4 days. The minimum was three days, the maximum, twelve days.

AGE

Under 2 years	37 per cent
2 to 4 years	36 per cent
5 to 16 years	27 per cent

SEX

The ratio of males to females was about 6:4.

MORTALITY

Only one uncomplicated case in this series resulted in death of the patient, even though both sides were involved in several instances. That one death was in a multiple-lobe case, both sides involved.

Hospital mortality in the series, 12 per cent. (Ultimate outcome of some cases leaving the hospital not determined.)

INCIDENTAL

Caseous lobar pneumonia (tuberculous) in 2 cases encountered incidentally showed an increase of density over that of ordinary pneumonia and I shall in the future consider unusual density as a possible clue to tuberculous caseation, although from the standpoint of physics I cannot explain it.

GENERALIZATIONS

Although in children clinical lobar pneumonia exists as an entity and is confirmed as such by the roentgen ray, in this series of cases its early stages are so often seen on the roentgenogram and the incomplete phases are so like other inflammations, which do not result in clinical lobar pneumonia, that one should have in mind always as a basis for diagnosis the physical progressive changes of lung inflammation in general.

Lobar pneumonia and lobular pneumonia in children often go hand in hand.

It seems rather unnecessary to add that physical examination in infants is so much less productive of definite diagnosis than in adults that roentgen examination is almost imperative in respiratory disease of children and should be used at the bedside in the home more than it is.

Finally, I have formulated these rules for my own guidance:

1. Do not predict the outcome of inflammatory spots.
2. Do not expect classical demarcation of all pneumonias which are clinically lobar or fibrinous pneumonia.
3. Insist upon lateral views with the affected side to the plate.
4. Refuse an overexposed plate which would blot out congestive stage shadows.

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TUMORS OF THE KIDNEY*

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IN undertaking a study of kidney tumors it seems well to adopt some classification in order to be familiar with the various types of tumors which may be found in the kidney. Many such classifications have been made. The following modification of the classification which Garceau[1] published in 1909 was adopted by Chetwood[2] and it seems to be the most simple and comprehensible:

A. *Solid tumors of the renal parenchyma*
  Malignant
    1. Hypernephroma
    2. Carcinoma
    3. Sarcoma
    4. Adenoma (malignant)
  Benign
    1. Adenoma
    2. Angioma
    3. Lipoma
    4. Fibroma
B. *Embryonic tumors*
    1. Dermoid (teratoma)
    2. Rhabdomyoma
    3. Mixed tumors
C. *Tumors of renal pelvis*
    1. Epithelial growth
      a. papilloma
      b. papillary epithelioma
      c. non-papillary epithelioma
    2. Mesodermal growths
      a. alveolar and round cell sarcoma
      b. angiosarcoma
      c. tumors of the capsule
      d. pararenal tumors
      e. cysts and cystic kidneys

Although the diagnosis of renal tumor by means of roentgenography was suggested by Voelcker and von Lichtenberg, it remained for Braasch of The Mayo Clinic to apply this method. His articles, which appeared in 1909 and 1912, demonstrated beyond doubt the feasibility of this method of diagnosis.

Any deformity or distortion of the renal pelvis or calyces may suggest the presence of a renal neoplasm, the location of which is indicated by the type of deformity or distortion which is observed.

Tumors developing in the cortex either compress or elongate the adjacent calyx by compressing the infundibulum. This may result in dilatation or obliteration of the distal end of the calyx. Such tumors may also encroach on the pelvis of the kidney, with resulting deformity, which is often typical of an extrapelvic growth.

Tumors of the renal pelvis cause deformity of the pelvis by encroachment on its lumen and this tumor mass may also obstruct the outlet of a calyx with consequent dilatation or obliteration.

Tumors of the kidney may also displace the pelvis or calyces or distort the ureteropelvic junction.

The only method of approach to the roentgenological diagnosis of renal tumors is by first obtaining a complete understanding of the gross pathology of these neoplasms, together with their characteristic manner of growth and extension. By this method we may anticipate what changes may be expected to take place in the size, shape and contour of the kidney. But at best we are often unable to determine the exact type of tumor with which we are dealing.

Hypernepbroma. Hypernephromata may be irregular in shape and nodular, in which case the shape of the kidney shadow will be affected, or they may be small and confined to the kidney cortex. Usually however, there is a fair line of demarcation between the tumor and the kidney substance, due to a fibrous capsule which surrounds each tumor. When the tumor penetrates its capsule it may invade the kidney substance, branches of the renal vein or the pelvis of the kidney. It is essential to remember these characteristics of hypernephromata in our study of tumors in the kidney. The presence of a capsule separating the kidney substance from the tumor leads to compression of the calyces with resultant elongation and terminal distention or to encroachment on or compression of the kidney pelvis. In its later development, hemorrhage takes place and necrotic areas of cystic degeneration appear, the capsule is broken through and invasion of

* Read at the Twenty-ninth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Kansas City, Mo., Sept. 25–28, 1928.

Fig. 1. Pyelogram of left kidney showing a markedly dilated pelvis probably due to a moderate hydronephrosis. Superior calyx cannot be made out.

On account of the presence of pus cells in urine from left kidney, diagnosis of infected hydronephrosis was made.

Fig. 2. Pyelogram of left kidney showing a calculus in infundibulum of left upper calyx with a filling defect involving part of the middle and lower calyx.

Operation disclosed an abscess of the left kidney with subacute nephritis and a calculus in the calyces at the lower pole.

Fig. 3. Pyelogram showing rotation of left kidney with a rather marked hydronephrosis and displacement of caudal calyces upward.

Operation disclosed cortical cysts, probably retention cysts, of the left kidney.

Fig. 4. Pyelogram of right kidney showing a small bud-like upper calyx. No solution has entered the superior calyx or the lower pole.

Operation disclosed a hypernephroma involving the lower pole of the right kidney.

FIG. 5. Pyelogram of right kidney showing a marked hydronephrosis with apparently no filling of cephalic calyx. The ureter is dilated in its entire length.

On account of the presence of tubercle bacilli in the urine, diagnosis of tuberculosis of the right kidney was made.

FIG. 6. Pyelogram of right kidney showing filling defect with displacement of calyces and pelvis.

Operation disclosed a papillary carcinoma filling the pelvis of the right kidney.

FIG. 7. Pyelogram of left kidney showing a large hydronephrosis principally involving the upper pole.

Operation disclosed a papillary adenocarcinoma involving lower pole of the left kidney.

FIG. 8. Pyelogram of right kidney showing some dilatation of the cephalic and caudal calyces and a dilated pelvis.

Operation disclosed a papilloma of the pelvis of the kidney. This case illustrates the possibility that a papillomatous tumor of the kidney may not produce any definite deformity that can be identified by pyelography.

Fig. 9. Pyelogram of left kidney showing a marked filling defect of the upper portion of the pelvis. The kidney is much enlarged. Operation disclosed a malignant tumor of the kidney involving the upper pole.

Fig. 10. Pyelogram of left kidney showing a large circumscribed deformity of the body of the kidney of the type produced by a tumor. Roentgen examination of the chest in this case showed a metastasis in the hilus of each lung.

the kidney substance and vessels complicates the usual pyelographic picture. Metastases through the blood stream occur usually in the chest, long bones or skull, or they may occur in any portion of the body. These tumors may also metastasize through the lymphatics.

In its early stages, a hypernephroma is usually practically benign; hence the importance of its early recognition and removal. The size of the tumor, however, furnishes no definite clue as to the presence or absence of metastases or to their extent. Small tumors may easily break through the capsule and metastasize, or may metastasize directly from the tumor into the blood stream, and the presence of a pathological fracture of a long bone which shows a tumor with all the pathological characteristics of hypernephroma may be the first indication of the presence of a tumor in the kidney. Often a very large tumor may be well enclosed within its capsule and no metastasis is present. A tendency to isolation is characteristic of these tumors, both primary and metastatic, a fact which may make it advisable to remove either single or multiple metastatic areas in the skull or in a long bone, together with the primary tumor in the kidney, because there is a possibility of obtaining a cure.

There has been much discussion regarding the etiology of these tumors. Grawitz believed that they were due to the presence of aberrant portions of suprarenal tissue, but this theory has often been disputed. We believe that the final conclusion will be to place hypernephroma well down in the list of tumors as regards frequency, and to place carcinoma at the head of the list.

Carcinoma. Published reports as to the incidence of carcinoma of the kidney vary. Many cases of so-called hypernephroma should, perhaps, be classified as cases of carcinoma. However, the solution of this problem remains within the domain of the pathologist.

The cells of a carcinoma are massed together and show no regular formation, and like carcinoma in other locations, it invades the surrounding tissue and includes

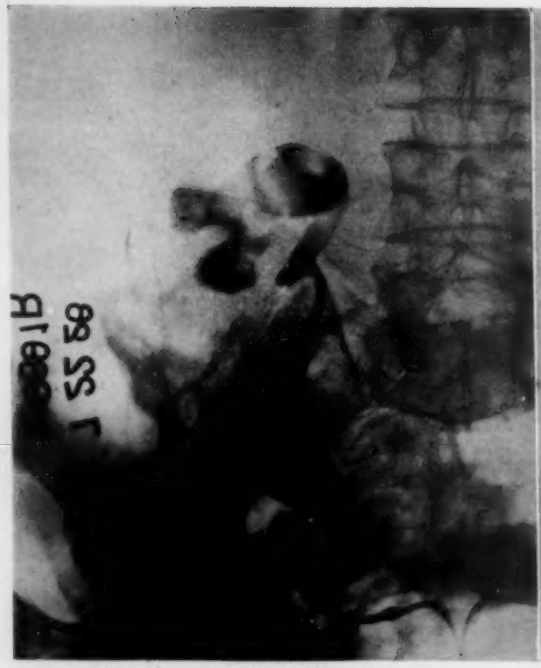

FIG. 11. Pyelogram of right kidney showing marked ptosis of kidney with a fragmented dilated pelvis of irregular outline, the center of which is encroached upon by what is apparently a tumor.

Operation disclosed a large hypernephroma which had broken through the superior calyx and filled practically the entire middle portion of the kidney.

FIG. 12. Pyelogram of the right kidney showing the pelvis and calyces to be rotated and the pelvis displaced upward. The pelvis and caudal calyx are somewhat enlarged, indicating improper drainage. The pelvis is also deformed by pressure from below.

Operation disclosed a hypernephroma of the lower pole of the right kidney.

it in its growth. Carcinoma shows little tendency to displace the calyces or pelvis of the kidney unless obstruction takes place, when a resultant distention follows; particularly is this true if the growth invades the ureter.

Carcinomata are usually smaller and of much greater malignancy than are hypernephromata. They usually develop from the epithelium of the renal tubules. They usually extend to the adjacent or neighboring glands, but they may metastasize to the lungs or liver.

It is evident that a carcinoma of the kidney should give a somewhat different picture from that produced by a hypernephroma because in the case of the former the tissue is invaded and consequently produces an irregular pelvic outline with serrated edges, instead of a displacement of the pelvis as in the case of the encapsulated hypernephroma. Areas of necrosis may be found in a carcinoma which will cause a fragmentation of the pyelographic shadow such as produced by pyonephrosis.

Sarcoma. A sarcoma of the kidney usually attacks the capsule or the perirenal tissue. Sarcomata vary in size and as they develop, areas of degeneration appear. Because of their location they do not cause changes in the kidney pelvis in their early stages, but may be detected on plain roentgenograms by irregularities in the kidney outline.

In children these tumors are usually a mixed tumor type rather than true sarcomata and they often attain a huge size, filling the entire abdomen. This palpable mass is usually the first recognizable symptom of kidney tumors, as they seldom cause urinary changes, hemorrhage, in particular, being almost never observed.

Benign Tumors. Benign tumors of the kidney are rare and of little interest to the roentgenologist except that in some instances they explain an otherwise unexplainable irregularity in outline which may be seen in the roentgenogram of a diseased kidney.

Embryonic Tumors. Embryonic tumors

of the kidney may appear in the form of a huge mass filling the entire abdomen, as in the case of the mixed tumors of childhood, or they may cause marked deformity or distortion of the kidney pelvis and lead to the suspicion of tumor, but these growths present no characteristic appearance by which they may be identified.

Tumors of the Renal Pelvis. Papillary tumors of the renal pelvis encroach on the pelvis and may obliterate it. The infiltrating type of carcinoma metastasizes into the kidney parenchyma. The papillary epithelioma often gives off direct implants into the ureter or bladder. As evidenced by pyelographic examinations, these tumors produce deformity of the kidney pelvis in their early stages.

Solitary Cyst. A solitary cyst of the kidney is a benign condition. It is usually a retention cyst and may reach an enormous size, with resultant atrophy of the kidney. Solitary cyst seldom produces symptoms except by mechanical pressure.

Its presence is betrayed by a visible distention of the pole of the kidney, which leads one to suspect a tumor mass. If large, such a cyst may displace or obliterate portions of the kidney calyces or pelvis, and this change may be recognized on a pyelogram.

Polycystic Kidney. This condition, which is usually bilateral, consists of a number of cysts containing colloid material which fill the entire kidney. These cysts distend the capsule and also enlarge the kidney, and often produce a typical picture on a plain film. Usually both kidneys are involved. A polycystic kidney is probably a congenital condition and is usually a familial disease.

Pyelography is often of value in the diagnosis of a polycystic kidney although the condition may be present without causing a visible change in the pyelographic shadow. The encroachment of the cortical cysts on the calyces and kidney pelvis causes the changes which are visible. It can readily be seen that such a pressure deformity might easily be confused with deformity caused by other types of renal neoplasm. Elongation of the calyces due to enlargement of the kidney is frequently seen, or a shortening may result from pressure on the terminal portion of the calyx. Areas of infection and destruction may appear, and this complicates the pyelographic shadow and frequently makes diagnosis difficult. The fact that the condition is often present in both kidneys is a very helpful diagnostic sign. It is also helpful to remember that the complete obliteration of calyces or pelvis which is sometimes effected by neoplasms is hardly possible in the case of multiple cysts. The calyces may appear as streaks through their entire length or they may be markedly broadened and elongated.

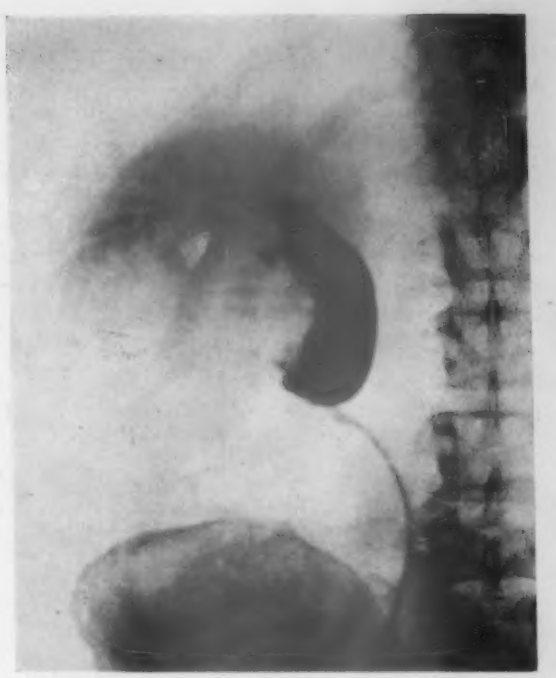

Fig. 13. Pyelogram of right kidney showing the pelvis and upper calyx to be dilated; the caudal calyces are absent and the upper portion of the pelvis is irregular in outline, probably because of the encroachment upon it of a tumor of the kidney.

Operation disclosed a papillary carcinoma of the renal pelvis.

We have reviewed the principal gross pathological changes observed in a group of kidney tumors with which the roentgenologist has to deal. His opinion as to the presence or absence of a neoplasm must be based on the resultant changes in the kidney pelvis and calyces. By means of a careful study of these changes he may also be able to determine the type of the growth, although many times the exact

type of tumor cannot be ascertained and it is usually only after complete correlation of the clinical history, urinary findings, and cystoscopic observations together with a comparison of the function of the two kidneys that a definite diagnosis can be made.

A survey of 47 recent cases in our own clinic shows the following occurrence of different types, together with the prevalence of the cardinal symptoms.

KIDNEY TUMORS

47 cases

Benign		Pain	
Lipoma	1	Hypernephroma	8
Leiomyoma	1	Carcinoma	5
Cysts	3	Sarcoma	0
Cystic Kidneys	7	Hemorrhage	
Hypernephroma	13	Hypernephroma	6
Carcinoma	12	Carcinoma	7
Sarcoma	10	Sarcoma	0
		Palpable	
		Hypernephroma	8
		Carcinoma	5
		Sarcoma	5

REFERENCES

1. GARCEAU, E. Renal, Ureteral, Perirenal and Adrenal Tumors, etc. New York and London, 1909.

2. CHETWOOD, C. H. Practice of Urology and Syphilology. Fourth edition. New York, 1927, p. 590.

Vol. XXI, No. 6

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Publishers: PAUL B. HOEBER, INC., NEW YORK

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 1909 Massachusetts Ave., N. W., Washington, D.C. Office of publication, 76 Fifth Avenue, New York.

Information of interest to all readers will be found on page ii.

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EDITORIAL

THE RELATION OF THE RADIOLOGIST TO THE HOSPITAL

THERE is increasing interest throughout this country in the status of the radiologist in hospital practice. It is an important question not only from the standpoint of the welfare of the radiologist but from that of the best interests of the patient and the general progress of radiology.

The Council on Medical Education and Hospitals of the American Medical Association has been investigating departments of radiology in hospitals with a view to establishing minimum standards for such departments. In the course of this investigation three important papers, "Radiology as a Medical Specialty" by Chamberlain;[1] "The Status of Radiology in America," by Desjardins,[2] and "The Radiologic Department in the Hospital," by Martin,[3] were read before the Annual Congress on Medical Education, Medical Licensure and Hospitals in Chicago, February 20, 1929. In these three papers are discussed a number of questions relating to the problem of the relation of the radiologist to the hospital. Chamberlain rightly recognizes the fact that the correct solution to the problem can be reached only after the status of the radiologist is defined in respect to the whole practice of medicine. He states that "Radiology is a kind of medical practice, and not simply a group of technical procedures." It is becoming increasingly recognized that radiology is a medical specialty requiring on the part of those who practice it a broad general medical knowledge and prolonged and thorough training in the use of the roentgen ray, radium and other forms of radiant energy in the diagnosis and treatment of disease. Those who have acquired such knowledge and experience are rightly accorded the status of consultants on a par with their confreres in internal medicine and surgery. As Chamberlain points out, there is an increasing tendency on the part of hospitals to consider the radiologist not as an independent practising physician carrying on his practice like an internist or surgeon, but rather as an employee of the hospital working under the direction of the hospital superintendent. If this should become the general practice it would in all probability have far-reaching results not now foreseen by those who are advocating it. It has already produced one bad result which is pointed out by Chamberlain; that is, the present difficulty in attracting the best young men to the practice of radiology. While serving their interneships young men see the radiologist serving as an employee of the hospital and they are unwilling to enter a specialty which requires them to practise under such limitations. If this condition becomes general we have not far to look for the end of progress in radiology; it is only by attracting to it first class men that any branch of medicine can maintain steady progress.

The relation of the radiologist to the hospital is part of a larger problem which must eventually concern the entire medical profession, that is, the relation of hospitals to the practice of medicine. There is undoubtedly a tendency on the part of hospitals everywhere to engage directly in the practice of medicine and surgery. The practice is most evident in compensation work but is indulged in to some extent with purely private patients. In some hospitals it is a common procedure for patients to be treated by internes or resident physicians for which bills are rendered and fees collected which go directly into the treasury of the hospital

[1] Chamberlain, W. E. *J. Am. M. Ass.*, March 30, 1929, xcii, 1033–1035.
[2] Desjardins, A. U. *Ibid.*, 1035–1039.
[3] Martin, Charles L. *Ibid.*, 1039–1040.

and not to the physician who performs the service. This is only an extension to general medicine and surgery of the practice of hiring a radiologist and collecting for the benefit of the hospital the fees which should go to the radiologist for his professional services. It ought to be plain to internists and surgeons that if a hospital can hire its anesthetists, pathologists and radiologists and collect the fees for their work it is a very short step to hiring internists and surgeons and collecting their fees. As pointed out above, this move has already begun in compensation work and to a smaller extent in private cases. If experience demonstrates that this is the inevitable trend in medical practice and that hospitals and other similar institutions are to assume entire control of the care of the sick the radiologist must take his place in the system along with other physicians. It is far from certain that any such radical change would be in the direction of progress. It seems much more probable that the problem will be solved by retaining for the physician his individuality, that element of individual initiative which is always so great a factor in progress, and at the same time working out methods of closer cooperation between the various individuals who must enter into the care of the sick. Until medical practice becomes completely institutionalized, if such condition ever occurs, it is only fair that the radiologist should be accorded his place on a level with other practitioners of medicine and should not be exploited for the benefit of a hospital.

While we thus hold that the hospital is under obligation to deal with the radiologist on the same plane as other members of its staff, we clearly recognize the fact that the radiologist has important obligations on his part. Martin, in the paper above cited, summarizes the qualifications of the radiologist capable of having charge of a radiological department in a hospital as follows:

"(a) A degree in medicine from a class A school.

"(b) A command of the best technical procedures used in the diagnosis of disease by roentgen-ray methods.

"(c) A thorough knowledge of the accepted principles of roentgenographic interpretation, with sufficient experience to insure a careful weighing of the data obtained on its merits. Constant contact with the rapidly changing radiologic literature is necessary and a properly kept reprint file in the department is a most useful adjunct. A man who writes good scientific articles himself is usually familiar with the writings of others, and the radiologist who is often found in the autopsy room and at the operating table is likely to be one who places the correct valuation on roentgen-ray observations.

"(d) A knowledge of modern medicine sufficiently broad to make him a true consultant. Any physician on the staff should feel free to go to the director of the department for advice when requesting roentgen examinations with the feeling that his patients will thereby receive the most efficient service with the least possible lost motion. Unnecessary and improperly ordered roentgen examinations make up a large percentage of the work in many institutions. Free discussion of the observations after the work has been done is also often helpful.

"(e) A broad knowledge of radiotherapy backed up by a reasonable amount of experience. A familiarity with electrophysics, particularly as it deals with dosage measurements, is necessary, but it is more important that the radiotherapeutist be versed in the diagnosis, course and prognosis under treatment of the various types of malignant and other conditions treated. Better therapeutic work in the average radiologic department is probably our greatest need. Unfortunately, appropriate instruction in radiotherapy is not easily obtained and proficiency comes slowly.

"(f) The ability and willingness to teach. Of course, the radiologist connected with a teaching hospital expects to devote a certain amount of time to lectures and demonstrations. It is desirable that his work be interlaced somewhat with the departments of anatomy, physiology and pathology, as well as with many of the clinical divisions. However, the man in the nonteaching institution can appreciably improve the standing of his department by so arranging his work that the interns receive regular instruction. Interesting radiologic demonstrations should also appear on the programs of the staff meetings at regular intervals. Such endeavors require extra effort but they invariably bear fruit.

"(g) Some familiarity with research problems. It is true that not every physician is fitted to do research work, but a surprisingly large number of radiologists have contributed some bit of knowledge of more or less impor-

tance to the specialty. Some have a mechanical tendency and have devised new technics or improved apparatus, while others have delved into the biologic problems of radiotherapy or have collected clinical data. Most departments have adequate facilities for work of this sort and a certain amount of creative effort invariably tends to redound to the credit of the department as well as to the institution as a whole. No specialty offers more interesting problems for investigation than does radiology."

With such qualifications there would be little doubt of the radiologist's ability to act as a consultant. Having such qualifications the only other essential is that he shall spend a sufficient length of time at the hospital each day to see every patient who is to be examined, to do whatever roentgenoscopic work is necessary and to properly interpret the films that are made. Granted that the radiologist has the requisite skill and experience, the value and even the amount of work done in his radiological department will be in direct proportion to the time he spends in it. If he is to act as a consulting physician he must see and examine the patient and know something of the history of the case as well as interpret his roentgenoscopic and roentgenographic findings. As a radiotherapist his duties may be even more exacting than they are in the diagnostic field.

If every radiologist takes this high view of his obligations there seems little doubt that he will finally be accorded the place even in hospital practice that he deserves. In the meantime it is not too much to ask that agencies such as the Council on Medical Education and Hospitals lend encouragement to the establishment of radiological departments in charge of well-qualified medical radiologists with a status on the hospital staff the same as that accorded to all other members. It is also fair to ask that hospital accrediting agencies, such as that established by the American College of Surgeons should give no encouragement to the further encroachment of hospitals upon medical practice by encouraging them to operate their own radiological departments.

A. C. C.

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Vol. XXI, No. 6

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan Ave., Toledo, Ohio.
Thirtieth annual meeting: Hotel Pennsylvania, New York City, Sept. 17–20, 1929.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting, Portland, Oregon, 1929.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Portland, Oregon, July 8–12, 1929.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Walter T. Bronson, Northwestern Univ. Med. School, Chicago, Ill.
Fifteenth annual session: New Royal York Hotel, Toronto, Canada, Dec. 2–6, 1929.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Lowell S. Goin, Wilshire Medical Building, Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. W. T. Bronson, Englewood Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.
Next meeting in Evansville, Ind., June, 1929.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. M. C. Sosman, Peter Bent Brigham Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Annual meeting, Charlottesville, Va., Oct. 18, 1929.

British Empire

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Director, Dr. John Muir, 32 Welbeck St., London, W. 1.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

Meets on the third Thursday of each month, from November to June inclusive, at 8.15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)

Meets on the third Friday of each month during the winter at 8. 30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS

Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Third session, Sydney, Sept. 2–7, 1929.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION

Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.

Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION

Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION

Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.

Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY

Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).

Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE

Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIETE FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE

Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA

Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)

Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.

Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT

Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT

Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY

Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA

Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.

Secretaries, Drs. S. A. Reinberg and S. G. Simonson.

Meets annually.

Sixth Annual Meeting, 1929, to be announced.

LENINGRAD ROENTGEN RAY SOCIETY

Secretaries, Drs. S. G. Simonson and G. A. Gusterin.

Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY

Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.

Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY

Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.

Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY

Secretary, Dr. B. Krynski, 11 Zielna St.

Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES

The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN

Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY

Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK

Secretary, Dr. O. Wissing, Copenhagen

Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND

Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY

Secretary, Professor Holzknecht, Vienna, IX, General Hospital.

Meets on the first Tuesday of each month from October to July.

VIENNA LETTER

(From our Special Correspondent)

"SUPER-RADIUM"

In some of the German radium institutes experiments are being carried on with a new alloy which is capable of radiating twenty times more gamma rays than any of the preparations now in use. The

alloy is obtained by melting radium with platinum, the method of melting being as yet kept a secret. If the results already obtained by the experimenters continue and are corroborated by other experimenters in foreign countries, the new alloy will revolutionize the radium industry since it will be much cheaper than the now costly radium. This will make radium available to all hospitals and other medical institutions. At the present price of fifty thousand dollars a gram only a few hospitals and clinics—in Europe at least—have been able to afford one gram, though this amount is necessary for obtaining the best results in the treatment of cancer. In addition to the costliness of radium, it was recently announced in a leading Continental journal that a scarcity of radium threatened. Recent statistics show that the world production of radium has decreased during the last few years in spite of the erection of new plants in Canada and Australia. The commercial preparation of the new alloy will start in the next few months.

CELEBRATION OF THE DISCOVERY OF RADIUM

Preparations are being made in Paris for the celebration of the discovery of radium. In the autumn of this year it will be three decades since Madame Curie in collaboration with her husband, Pierre Curie and their assistant Bemont, discovered radium. It was Professor Becquerel, the French physicist who shortly after the discovery of the *x*-rays hit upon the idea that somewhere in Nature there must be substances which would emanate rays similar to those found by Röntgen. He soon succeeded in finding such a substance—uranium—and although he was not successful in revealing the peculiar radiating phenomena of this element, it was the first radioactive material found. The Curies found in pitchblend from Czechoslovakia a further radiating substance. They laboriously worked up enormously large quantities of this substance in order to discover the "radiating kernel"—not less than one thousand kilograms to finally obtain 10 centigrams. This however showed radiation a million times stronger than uranium. The first batch of radium was chemically impure and it was not until about the end of the year 1906 that Madame Curie, assisted by the famous chemist Debierne, succeeded in producing chemically pure radium.

QUICKENED CLOTTING TIME OF BLOOD UNDER ACTION OF ROENTGEN RAYS

Dr. Harvath of Budapest has carried on extensive experiments concerning the action of roentgen rays upon the clotting time of blood, and also upon the stopping of hemorrhages. In a report before the Budapest Royal Medical Society he stated that the method seemed at least worth a trial. The technique which he uses is as follows: The patient, with a normal sized spleen and regular displacement, is laid on his right side, resting his left arm pulled high above his head on the treatment couch. Corresponding to the dullness of the spleen a field 20 × 15 cm. is exposed to the rays; 30 kv., secondary voltage, 8 ma., through 5 mm. Al, 30 cm. skin focus distance, the quantity of the rays applied representing 25 per cent of the tolerance dose. The irradiation is repeated after four weeks. If blood clotting is yet imperfect, the treatment is repeated after three more weeks. More than three to four irradiations are unnecessary in one series of treatment.

CINEMATOGRAPHIC ROENTGENOGRAMS OF THE HEART

At the Institute for Physical Therapy and Roentgenology in Munich Dr. P. Stumpf gave an account of his new apparatus which enables him to make the most perfect cinematographic roentgenograms of the heart. The apparatus is enlarged by the addition of a so-called "densograph" which, as its name implies, directly displays the density of the organs in roentgenoscopy and is helpful both in roentgenoscopy and roentgenography. With the aid of the densograph differences in density may be distinguished on the roentgenogram, thus rendering the reading of films extraordinarily exact. The apparatus draws lines automatically which connect all spots of similar density, comparable

to iso-lines on geographic maps. By use of this arrangement the form of the organs is reflected in denso-relief, the importance of which cannot be over-estimated. Densography of the heart means the very accurate record of the changes of shape of the heart during pulsations. It also shows the density variations of the single parts of the heart and their filling during the beat phases. The apparatus is expensive and is as yet not obtainable.

ROENTGEN TREATMENT OF SWEAT GLAND ABSCESSES

According to Dr. E. Kahnt, sweat gland abscesses, which sometimes show a very obstinate course, may be healed in a short time by the combination of surgery and roentgen therapy. Ripe abscesses are incised and infiltrations are rendered ready for incision by the application of moist warm dressings. After the surgical intervention roentgen radiation is used to destroy the glands—the radiation seldom being used prior to the surgical intervention. A dose of 20 per cent S.U.D. is applied through 5 mm. Al and after four to five days 65 per cent S.U.D. is administered, or a total dose of 85 per cent S.U.D. Of all patients thus treated only 2 suffered a relapse, and in these the recurrence was in the non-irradiated arm-pit. On the other hand, relapses were much more frequent in cases receiving other than radiation treatment.

CHANGES IN THE TISSUES OF HEALTHY RABBIT EYES CAUSED BY ROENTGEN RAYS

Dr. W. Rohrschneider, a distinguished roentgenologist, induced by the divergent views met with in medical literature as to the effect of roentgen treatment, carried on extensive experiments on rabbits to see what objective changes are provoked by roentgen rays in the tissues of the healthy eye. He applied rays of two kinds of hardness supplied by a Neo-Intensiv apparatus, the output of which amounts to 188 kv. The intensity of the rays applied was 4 ma. A series of rabbits were exposed to these rays through 3 mm. aluminum filter. He found that epilation of the eye lashes could be produced after eight minutes' application of the rays under these conditions. Measuring this quantity of rays it corresponded to 170 per cent S.U.D. As regards the eye itself, no serious changes were noted up to 150 per cent S.U.D. on the conjunctiva, the changes noted being only temporary and not considered pathological. Disintegration of of the cell nucleus and slight hyperemia were seen. By giving 200 per cent S.U.D. however, a shrinking of the conjunctival fold was observed. Irradiation with soft rays caused much more demonstrable changes. Usually the application of one epilation dose was followed by the destruction of the epithelium, the shrinking of the transitional fold, and in some cases adhesion of the bulbar and tarsal conjunctiva was noticeable. In none of the cases did he notice hyperesthesia of the cornea. The epithelium of the cornea was damaged after the application of 150 per cent S.U.D. of the harder and 100 per cent of the softer rays. Disintegration of the nucleus and vacuolic degeneration of the plasma which were seen here and there have regenerated after a certain period. Deeper changes such as keratitis and the formation of ulcers were met with only after the application of 200 per cent and 100 per cent epilation doses respectively. The reaction of the uvea did not extend in any of the experimental rabbits beyond an early and slight hyperemia; it did so, however, in the iris, causing slight disturbances in the fluid in the anterior chamber. Obliteration of the vessels, their pearl-like dilatation or the degeneration of their intima could not be discovered in a single case. Neither did an increase of intraocular tension occur after irradiation. On the contrary, in some cases there was a fall of the normal intraocular tension.

OVARIAN CYST DIAGNOSED BY ROENTGEN RAYS

At a recent meeting of the Roentgen Society of Magyar Physicians in Budapest, Dr. I. Markovics, late assistant of Professor Holzknecht, reported the case of a patient aged fifty-three who had a swelling in her abdomen extending over a period of several years, which lately had caused her considerable inconvenience. She was sent to his laboratory with a diagnosis of

tumor of the kidney. Examination of the urine showed no pathological changes. Examination of the function of the kidney was also reported normal. Pyelographic examination was made which showed that the left renal pelvis and the calyces were compressed. The left ureter, particularly in its upper third, was displaced towards the vertebral column. Under the lower pole of the left kidney a rounded, narrow, ring-like shadow the size of a fist was seen. The character of the shadow reminded one of an opacity which is generally caused by calcification. Within the shadow several similar shadows of lime density were observed. The roentgen examination indicated the presence of an extraperitoneal cyst. The patient was operated upon shortly after the roentgen examination and an ovarian cyst fixed to the peritoneum in the left side of the abdomen was removed. The patient made an uneventful recovery.

A NEW KIND OF VIEWING BOX

At this same meeting Dr. Joseph Edélyi exhibited a new film viewing box in which he had tried to eliminate the faults of the present type of viewing boxes. In his particular type the diaphragms are displaced directly behind the transparent glass and can be adjusted simply. In both the horizontal and vertical directions one can set in smaller or larger sight fields as the case demands, making it possible to scrutinize all parts of the film separately. The intensity of the light can be varied by a switch. The construction of the diaphragm is such that it dispenses with the disadvantages of the roller type diaphragm; there are neither springs nor any other fragile parts which become easily displaced. One great advantage of this type viewing box is that it scarcely increases the volume or the size of the viewing box. It may be used for films of 40 × 40 cm. in size. Its dimensions are: height 59.5 cm., width 59.5 cm., depth 18 cm.

ROENTGEN-RAY SOCIETY OF CENTRAL PENNSYLVANIA

The Fourteenth Annual Spring meeting of this Society was held in April at the Hotel Dimeling, Clearfield, Pennsylvania, about 60 members being present. Incidentally, it was also the last meeting of this Society, at least so far as the name is concerned, since it was decided to change the name to Pennsylvania Radiological Society to indicate more accurately the scope of its membership. The Roentgen-Ray Society of Pennsylvania was formed in Altoona fourteen years ago and the organization meeting adjourned to hold the first business session in Clearfield.

The following officers were elected for the coming year: President: Dr. J. M. Keichline, Huntington; Vice-President: Dr. William Levering, Stroudsburg; 2d Vice-President: Dr. A. L. Benson, Philipsburg; Secretary-Treasurer (re-elected): Dr. W. E. Reiley, Clearfield; Censor: Dr. W. E. Reiley, Clearfield; Editor of the Pennsylvania Journal of Roentgenology (re-elected): Dr. G. D. Bliss, Altoona.

SECTION ON RADIOLOGY AMERICAN MEDICAL ASSOCIATION

The following is the program for the Section on Radiology of the American Medical Association to be held in Portland, Oregon, July 8–12, 1929, the sessions of the Section on Radiology being held on the forenoons of July 10, 11 and 12.

WEDNESDAY A.M., JULY 10

Fundamentals of Roentgen-Ray Treatment. H. J. Ullmann, Santa Barbara, Calif. Discussion to be opened by G. M. MacKee, New York City.

Fewer Variable Factors of Technique in Roentgen Therapy. A. W. Erskine, Cedar Rapids, Iowa. Discussion to be opened by E. C. Ernst, St. Louis, and U. V. Portmann, Cleveland.

End-Results after Radiation of Fibromyomata. Francis Carter Wood, New York City. Discussion to be opened by Henry Schmitz, Chicago.

Radiotherapy of Chronic Tonsillitis and Pharyngitis. Leila C. Knox, New York City. Discussion to be opened by Jos. Aspray, Spokane, Wash.

Chairman's Address. M. J. Hubeny, Chicago.

Radiation in the Treatment of Carcinoma of the Breast. G. E. Pfahler and Leo D. Parry, Philadelphia. Discussion to be opened by R. E. Baumgarten and Roy A. Payne, Seattle, Wash.

Radiation Service for the Modern Hospital. Albert Soiland and Orville N. Meland, Los Angeles, Calif. Discussion to be opened by C. J. Johannesson, Walla Walla, Wash., and H. B. Thompson, Seattle, Wash.

Histological Changes in the Skin Following Irradiation. E. A. Pohle and C. H. Bunting, Madison, Wis. Discussion to be opened by W. E. Chamberlain, San Francisco.

THURSDAY A.M., JULY 11

Joint meeting with the Section on Gastro-Enterology and Proctology

Clinicians:

Malignant Lesions of the Lower End of the Esophagus and Upper Portion of the Stomach. Max Einhorn, New York City. Discussion to be opened by J. M. Blackford, Seattle, Wash.

A Consideration of Chronic Ulcer of the Lower Esophagus and Upper Third of the Stomach. F. A. Speik, Los Angeles. Discussion to be opened by Frank Smithies, Chicago.

Roentgenologists:

Malignant Lesions of the Lower End of the Esophagus and of the Cardiac End of the Stomach. P. M. Hickey, Ann Arbor, Mich. Discussion to be opened by B. H. Orndoff, Chicago.

Non-malignant Lesions of the Lower End of the Esophagus and of the Cardiac End of the Stomach. A. B. Moore, Rochester, Minn. Discussion to be opened by R. R. Newell, San Francisco.

FRIDAY A.M., JULY 12

Accidental Pneumothorax with Report of Two Cases. Joseph Harvey, Denver, Colo. Discussion to be opened by Kenneth Allen, Denver.

Carcinoma of the Lung. Lloyd Bryan, San Francisco. Discussion to be opened by F. H. Rodenbaugh and Harold Brunn, San Francisco.

Broncho-sinusitis Disease. W. Walter Wasson, Denver, Colo. Discussion to be opened by T. E. Carmody and T. D. Cunningham, Denver.

Esophageal Orifice Hernia. Max Ritvo, Boston, Mass. Discussion to be opened by A. L. Gray, Richmond, Va., and E. P. Richardson, Boston.

Diverticula of the Stomach, with a report of five cases in which the diagnosis has been verified at operation. Ross Golden, New York City, and J. C. Bell, Louisville, Ky. Discussion to be opened by E. S. Allen, Louisville.

The Roentgenologic Diagnosis of Pedunculated Tumors and Gastric Mucosa Prolapsing through the Pylorus into the Duodenum. Eugene P. Pendergrass, Philadelphia. Discussion to be opened by E. L. Eliason, Philadelphia.

Roentgenographic Characteristics of Bone Lesions. C. G. Sutherland, Rochester, Minn. Discussion to be opened by W. B. Bowman, Los Angeles.

Experimental Biophysics of Normal and Abnormal Bone Growth. Eben J. Carey, Milwaukee, Wis. Discussion to be opened by Lemuel D. Smith, Milwaukee.

ADVISORY COMMITTEE ON X-RAY AND RADIUM PROTECTION

The International Committee on X-Ray and Radium Protection has as its American member Dr. Lauriston S. Taylor of the Bureau of Standards, Washington, D. C. An Advisory American Committee on X-Ray and Radium Protection has been chosen to cooperate with Dr. Taylor and is composed of the following members:

Dr. W. D. Coolidge, General Electric Co.
Dr. H. K. Pancoast, Philadelphia
Dr. G. Failla, New York City
Dr. R. R. Newell, San Francisco
Dr. J. L. Weatherwax, Philadelphia
Mr. W. S. Werner, Kelley-Koett Mfg. Co.

E. C. JERMAN RECEIVES HONORARY DEGREE

At its annual commencement, Monday, June 10, 1929, Franklin College, Franklin, Indiana, conferred upon Mr. Ed. C. Jerman the honorary degree of Doctor of Science. This degree was given in recognition of Mr. Jerman's important contribution to the standardization of roentgen-ray technique.

Vol. XXI, No. 6

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

THE NEON "GLOW" LAMP AS A POLARITY INDICATOR*

BY FRANCIS W. BISHOP

ROCHESTER, NEW YORK

A FAMILIAR device, virtually a necessity and certainly a convenience, is the polarity indicating device which has its place on the switchboard of all roentgen-ray machines employing the mechanical rectifier. The polarity indicator consists usually of a polarized ammeter connected to the primary alternating current circuit through a rectifying mechanism, which is attached to the shaft of the synchronous motor used to drive the high-tension rectifier (Fig. 1).

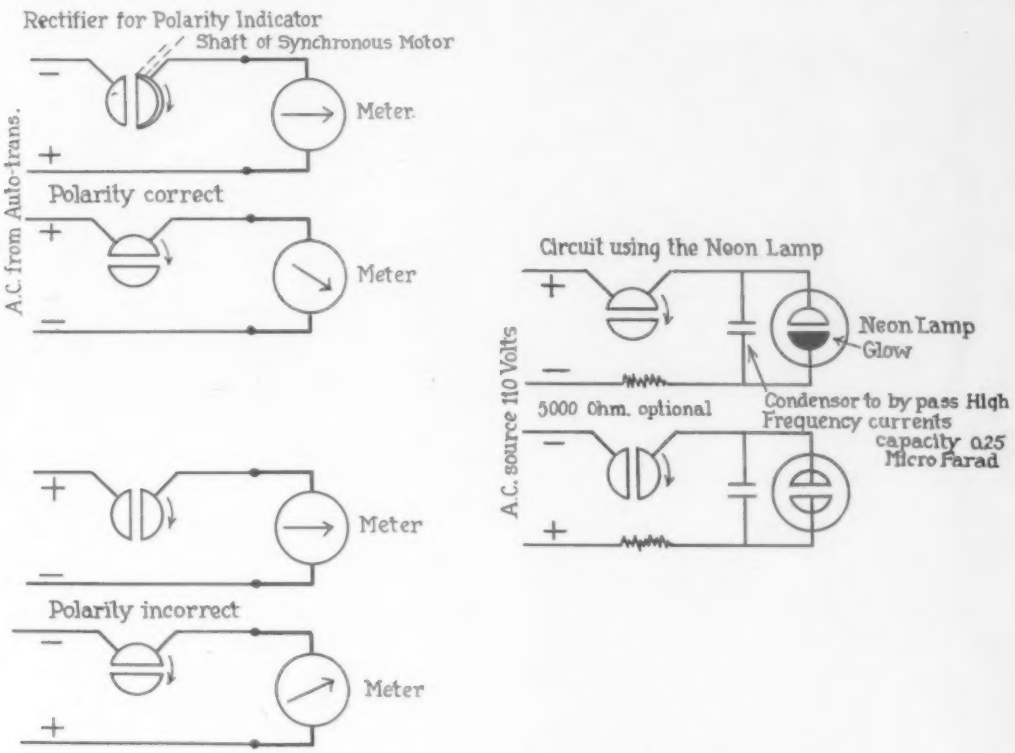

FIG. 1. Diagrams showing the circuit and theory of the polarity indicator.

Despite the simplicity of this arrangement, we are sometimes annoyed by the failure of the more delicate part of this system—the meter. Meter repair or replacement is somewhat expensive. We have adapted a simple device which replaces the meter entirely and operates to our entire satisfaction, i.e., the neon lamp.

While neon lamps have been extensively used for advertising purposes, it is only recently that they have been put on the market in small sizes and with standard bases. The lamp consists essentially of a

* From the Department of Radiology of the University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.

glass bulb, filled with neon gas under reduced pressure, into which are sealed two electrodes. This is mounted on a standard base. The dimensions of our lamps are 2 inches over-all with a bulb

Fig. 2. Control stand showing mounting of neon lamp. (a) Neon lamp in operation (glow is visible); (b) (insert) neon lamp removed from socket; (c) this machine employs two synchronous motors. Polarity-indicator meter of one is retained for comparison.

approximately 1¼ inches in diameter. These are rated to operate on 115 volts A.C. (effective). The current consumption at this voltage is between 4 and 5 ma.

When operated on alternating current, both of the electrodes of the tube glow with the characteristic red color of ionized neon. On direct current, however, only one electrode will glow, depending upon the polarity. The negative pole glows, the positive remains dark.

We have therefore been able to substitute the lamp for the meter of the polarity indicator on our roentgen machines (Fig. 2). The neon lamp is a voltage operated device, and unless the applied voltage is higher than a critical value (in the case of our lamps, 115 volts, A.C.), the lamp does not function at all. If a lamp refuses to glow when substituted for the meter, it is probably because the applied voltage is too low. Raising the voltage tap which feeds the polarity indicator will remedy this difficulty. When the synchronous motor is running, either one electrode or the other will glow. One test of the machine will tell which one should glow when the polarity is correct, and the lamp should be so marked. A radio by-pass condenser should be connected across the lamp to prevent the passage through the lamp of high frequency currents which may be present. Condensers having a capacity of 0.25 microfarad are ample. The neon lamps which we use* are very inexpensive and have an indefinitely long life. The lamps may be protected and the voltage adjusted by the insertion of a series resistance. An ordinary radio grid leak having a resistance of approximately 5000 ohms is sufficient.

The total cost of parts for this polarity indicator need not exceed $1.50. Numerous applications of the neon lamp will suggest themselves to experimenters.

* These are manufactured by the Cooper Hewitt Electric Company.

Vol. XXI, No. 6

METALLIC CONJUNCTIVAL MARKERS, AN AID IN THE LOCALIZATION OF INTRAOCULAR FOREIGN BODIES*

BY JAMES M. PATTON, M.D.

OMAHA, NEBRASKA

THE consideration of the localization of foreign bodies in the eye should be of equal interest to the roentgenologist and ophthalmologist, for while the responsibility for the final disposition of the eye in question lies with the ophthalmologist, his judgment is of necessity often based on the localization data furnished by the roentgenogram. Thus, the closest co-operation and strictest attention to details are of importance in order to render patients the maximum service.

It is well within the memory of most of us when we were well pleased if we could get a shadow which would enable us to detect the presence of a foreign body. I recall our satisfaction when my colleague, Dr. Harold Gifford, in 1903, was able to get the shadow of the breach block of a rifle which, following an explosion, had been lodged for a number of years in the patient's right anterior sinuses. The eye had been destroyed at the time of the accident, the wound had healed, and no one suspected that the foreign body had been retained until it was revealed by the roentgen ray. Another patient whose eye was badly lacerated by what he was sure was a railroad spike was found instead to have a good-sized fragment of the spike moll in his orbit.

With the rapid improvement in apparatus and technique the need for exact methods of localizing foreign bodies in the eye was recognized. While the difference of a few millimeters in the location of a foreign body in the tissues of the hand or back is of little consequence, a variation of a millimeter or so in the eye might result in an enucleation which with more exact localization could have been saved.

Early efforts at localization were directed toward fastening suitable opaque substances, usually wire, on the skin of the lids and temple of the affected side. One ophthalmologist (Fox) surrounded the globe by a ring of wire placed well back in the conjunctival fornices. Even as late as 1918 McGrigor[5] advised the use of crossed wires placed in the cell of a testing frame as close to the closed lids as possible, and then by means of a tube shift he was able to estimate the position of an intraocular foreign body. He reported satisfactory results in suitable cases but indicated that the method could not always be depended on for accuracy.

These methods were an advance but they were open to the objection in some instances of being too far removed from the globe and in all that there was no way of checking the position of the eyeball at the moment of exposure as the globe could move independently of the opaque marker.

Extreme rotation of the globe with plates taken in each of the various positions gave valuable information if the foreign body was in position where it would show displacement on the several plates but if the foreign body was near the center of rotation or directly inside or outside of the sclera the procedure was of little value and in some instances resulted in the removal of an eye for a supposed intraocular foreign body when it was found after operation to be in the orbit outside the globe. Even with the use of a carefully adjusted movable target as suggested by Verwey[8] and the displacement used as a basis for localization, determined by a given mathematical formula, it should not be relied upon in questionable cases.

In recent years intraocular localization has been secured by two groups of methods. Namely, one of the so-called geometric methods of localization, the use of contact localizers, or what may be better in some instances, the combination of both.

The various methods of localization as suggested by Dixson, McKenzie-Davidson, and others are well known. Dr. J. M. Woodburn Morison, head of the Department of Roentgenology of the Royal Infirmary in Edinburgh recently called my attention to a method proposed by Dr. Pirie[7] of Montreal during the World War. The

* Read at the Twenty-ninth Annual Meeting, American Roentgen Ray Society, Kansas City, Mo., Sept. 25–28, 1928.

necessary equipment is not expensive, the method is comparatively simple and seems to merit more attention than it has received. The equipment consists of an accurately made steel right angle, having

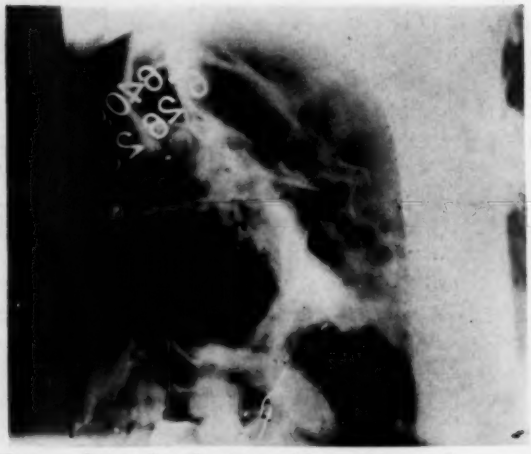

FIG. 1. Sweet localization with conjunctival contact markers showing upward rotation of the eye at the moment of exposure causing misleading localization. (A) Sweet cone and ball; (B) contact markers; (C) foreign body.

attached to it a fixed foreign body and a small mirror. After exposure the exact position of the foreign body is estimated by means of a formula. The results he has been able to secure are encouraging and warrant careful consideration of his methods.

Comberg[1] has recently published a method which is also worthy of careful consideration and is a definite attempt to combine in one procedure the contact and geometric methods of localization. He first applies to the cornea a Zeiss contact glass in which are four opaque spots arranged in the form of a square, each point being an equal distance from the center of the glass. The patient is then placed face down on the plate. The target is adjusted to exactly 60 cm. from the plate, fixation is secured by a small black surface mirror, placed at an angle of 35 to 40°, and a small electric torch accurately placed at a distance of 2 meters, the usual anteroposterior exposure being made. The lateral exposure is made with the patient in sitting position, the position of the tube and fixation point being very carefully determined. The location of the foreign body is then determined from the two plates, using the four opaque spots of the contact glass as the basis of calculation and plotting the results on special charts which he has prepared. Comberg states that he has been able to get results

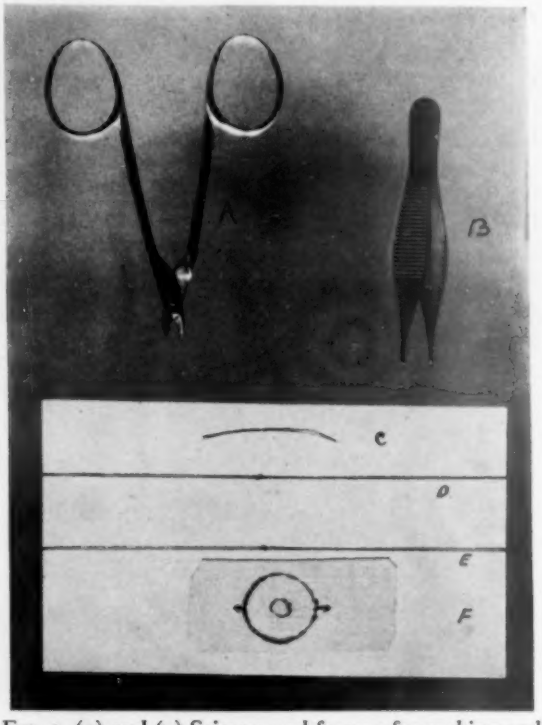

FIG. 2. (A) and (B) Scissors and forceps for making and applying rings; (C) No. 28 silver wire; (D) sliver of lead clamped on silk suture; (E) Bit of wire clamped on silk suture; (F) method of application.

with a variation of only from 0.5 to 1 mm. The method is open to the criticism that the contact glass is somewhat expensive, not always easy to apply and there is a remote possibility of a slight displacement during exposure. The method certainly deserves careful investigation and his article should be studied by all who are doing any intraocular localization.

The method proposed by Sweet of Philadelphia and later modified by Snook and Bowen is, perhaps, the most generally used of any of the geometric methods. For several years previous to the introduction of the Sweet method my colleague, Dr. Gifford, had been using conjunctival contact localizers and later continued to do so in connection with the Sweet technique. This proved very satisfactory until the

following incident caused us to rely more completely on the contact markers and to use the combined contact-Sweet technique only in cases where an additional check as to localization was desirable.

Fig. 3. (A) shows coin silver rings clamped on conjunctiva above and below cornea.

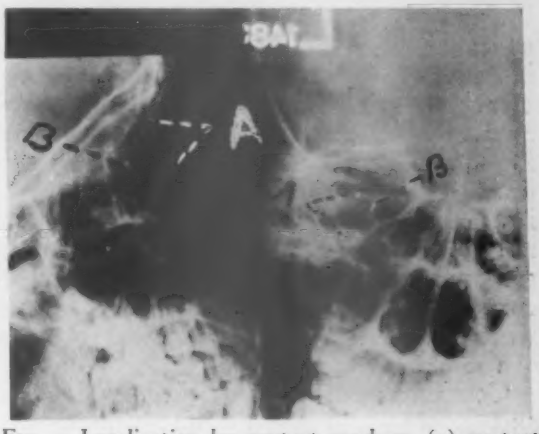

Fig. 4. Localization by contact markers. (A) contact markers; (B) foreign body.

C. M. T., a man aged twenty-two, stated that while pounding on metal with a hammer some weeks before consulting us, something struck his left eye. There was no external evidence of a wound but the eye was deeply congested and there was a spot near the lower border of the iris which may have been traumatic. No foreign body could be seen in the interior of the eye. Contact markers were applied and the patient sent for a Sweet localization (Fig. 1); a report was made that there was a small foreign body 1 mm. temporal and 2 mm. back of the center of the cornea. This was somewhat surprising as we had been able to get a clear view of the pupillary space with no evidence of a foreign body. We therefore examined the plate more closely and we found that the contact markers clearly showed that the patient had unconsciously, without the knowledge of the operator, rotated the eye upward about 20° and instead of the foreign body being 2 mm. back of the center of the cornea, as indicated by the Sweet method, it was in reality about 1 mm. up and back from the lower marker almost exactly at the root of the iris. The foreign body was then brought around into the anterior chamber and delivered without difficulty with the magnet.

As stated above, contact markers of one sort or another, were in early use and have been of distinct advantage as they do indicate the exact position of the globe at the moment of exposure as well as provide two known fixed points from which the location of the foreign body can be determined.

Various methods of applying these markers have been devised. Gifford[2] inserted small bits (about 2 mm. long) of sterilized silver wire into the subconjunctival pockets as close to the upper and lower limbus as possible. Holth[3] and von Libermann[4] sewed small buttons of lead to the bulbar conjunctiva. Gifford later suggested pinching split shot or small bits of lead onto the conjunctiva after the manner of split shot fish line sinkers. These were found to be impractical as they were very hard to remove if put on tight enough or if not, came off before the exposure was complete. However, they did suggest the employment of the small rings which we have been using with satisfaction for the past few years.[6] I have no doubt that the same or similar procedures have been employed by others. The only essential is a piece of light flexible wire, preferably No. 26 soft silver suture wire. A 2 mm. ring is made by bending the end of the wire around narrow forceps and cutting it off with scissors (Fig. 2). The conjunctiva is then cocainized, and grasped about 3 mm. from the limbus with light mouse-tooth forceps and the open ring clamped over the conjunctival fold between the forceps and limbus (Fig. 3). After the exposure, the ring is easily removed by snipping it with scissors.

This method has been especially satisfactory on account of the ease of applica-

tion, and avoids wounding the conjunctiva. Where the rings are not available a short fold of the wire or a thin sliver of sheet lead may be clamped onto a light silk suture, the needle passed through a fold of the conjunctiva as close to the limbus as possible and tied so that the marker is firmly in contact with the conjunctiva. This marker is easily removed and the slight conjunctival trauma is of no consequence. An anteroposterior and lateral exposure should always be made and, except under very unusual circumstances, a satisfactory localization can be secured (Fig. 4). A further aid to localization is secured if markers are placed at the horizontal margins of the cornea as well as above and below. This will show lateral as well as vertical rotation of the globe.

Contact markers are very easily applied and removed. They do not wound the conjunctiva to any appreciable extent and require no special skill or experience in reading the results and if the markers are small so that they do not overshadow the foreign body and are placed as near the limbus as possible, they leave little to be desired, However, in questionable cases the addition of one of the geometric methods is of value, providing the exposure is made with the contact markers in place so that the exact position of the globe at the moment of exposure can be definitely determined.

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INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

Albrecht, H. U. The relief of the pathological mucous membrane of the stomach in the roentgenogram and its clinical importance. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, February, 1929, xxxix, 231–249.

The visualization of the rugae of the stomach by means of contrast media is important in the diagnosis of pathological conditions originating from the mucous membrane of the stomach. The author applies the technique of Berg by using barium sulphate in a solution 3:4. After a slow ingestion of the mixture, examination is made by palpation in different positions and then roentgenograms are taken "with regulated compression." The study of the folding of the mucous membrane is more or less important in the following conditions: (1) Gastritis. The majority of the cases of carcinoma and ulcer of the stomach are associated with a rather severe gastritis. The foldings in such instances are thickened and edematous, in places giving a washed out appearance. The condition is observed also in alcoholics and in stasis due to cholecystopathies and decompensated heart lesions. Konjetzny was the first to call attention to the fact that the persistence of a gastritis following gastroenterostomy is a sign of irreparable damage to the mucosa of the stomach. This is important from the point of view of the permanency of the results to be obtained by gastroenterostomy in gastric ulcers. (2) Ulcers. The changes in the folding of the mucous membrane are very characteristic, there being a funnel-shaped arrangement of the folds towards the crater of the ulcer. A few roentgenograms illustrating this condition are reproduced. (3) Polyps. One case of a polyp of the stomach is described in detail showing the importance of the visualization of the mucous membrane in this lesion. The location as well as the size and shape of the polyp, which was pedunculated, could be accurately estimated previous to the operative intervention. In connection with this the author insists on the possibility of malignant degeneration of polyps and advises that instead of local removal, a resection of the stomach be performed in all such cases. (4) Carcinoma. The visualization of the gastric folding is of the greatest importance in the diagnosis of early carcinoma of the stomach. A defect with rigidity of the mucous membrane around the defect is pathognomonic of carcinoma. An irregular outline of the defect with a central portion of lessened translucency is indicative of a carcinoma crater. In a diffuse infiltration of a larger portion of the stomach the changes occur especially in connection with the architecture of the foldings of the mucous membrane. In a few clinically suspected cases the author was able to rule out carcinoma by the visualization of a normal relief of the mucous membrane folding.—*T. Leucutia.*

Anderson, Robert L. The normal and the abnormal kidney (pelvis) and ureter. *J. Am. M. Ass.*, Dec. 8, 1928, xci, 1792–1794.

The diagnosis of kidney conditions depends on several factors in addition to the pyelogram and demands close association of the roentgenologist and the urologist. Diagnostic criteria are: careful history and physical examination; appearance of the ureteral orifices; free or difficult passage of catheter to pelvis; residual urine in kidney pelvis; examination of catheter specimen; status after properly directed and adequate treatment; change in contour of papillae; change in urine; changes in subjective symptoms.

Pyelograms should be made only when the diagnosis cannot be made by other examinations or to confirm the diagnosis. They give information only as to the status of the adjacent structure. Normal minor calyces are cupped or lily-shaped. Flattening or clubbing of the shadow always means recession of the papillae. Streaks radiating from the border of the calyx indicate that the opaque fluid has entered dilated secreting tubules unless too much pressure has been applied, and indicate pyelonephritis.

The uretero-pelvic junction is next in importance. Ureterograms are more uncertain. Angulations, kinks and tortuosities are best shown by stereoscopic films. Pathological changes are very often associated with malformations of the urinary tract.—*R. Golden.*

Bager, Bertel. A new point in roentgenography of diaphyseal fractures of the extremities. *Acta. chir. scan.*, 1928, lxiv, 384–386.

In order to determine the direction of the displacements of the fragments in diaphyseal

fractures, the author advises a simple method of orientation. Miniature lead models of the extremity are placed on the film at the time of the roentgen exposure in such a way as to correspond to the actual position of the extremity (the models being cut in antero-posterior and lateral views and used correspondingly). The miniature lead model can be bent so as to imitate the shape of the extremity in case of marked deformity. Such a procedure facilitates the interpretation of the film and permits a more accurate estimation of the position of the fragments in relation to the axis of the extremity.—*T. Leucutia.*

BALABAN, I. J. A lithopedion with a simultaneous normal pregnancy. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1929, xxxix, 341–342.

The author describes the coincidence of a pregnancy of full term and lithopedion in a woman thirty-one years of age. The previous history shows that first there were two normal deliveries which were followed by a third pregnancy which, however, never came to delivery. Two other pregnancies with normal delivery have developed later. This time the patient came for observation, with symptoms of a sixth pregnancy. Roentgen examination revealed in addition to the structures of a fetus near term also structures of a old lithopedion. This is the only case found in the literature where three normal deliveries occurred in a woman with lithopedion.—*T. Leucutia.*

BALFOUR, DONALD C., and HENDERSON, EARL F. Benign tumors of the duodenum. *Ann. Surg.*, Jan., 1929, lxxxix, 30–35.

The authors have collected 8 cases in the literature and have added 4 cases of their own to the previous reports of collected cases of benign tumors of the duodenum. Of the 6 cases observed at the Mayo Clinic, 2 tumors were myomas, 2 were adenomas, one was an adenomatous polyp, and one was a hemangioma.

They state that a diagnosis of benign tumors of the duodenum can only be made by the roentgen ray. Unless the tumors are large, however, it is difficult to visualize them on account of the rapid passage of the medium through the small bowel. Two of the tumors of the series were diagnosed as such by the roentgen ray. While gross gastric tumors or melena should suggest the possibility of benign duodenal tumor, other intragastric and duodenal lesions which may have produced it are so much more common that it is indeed a remote possibility. So far as they have determined an instance of such tumors having undergone malignant degeneration has not been reported.—*R. S. Bromer.*

BALLON, DAVID H. The technique of bronchoscopic pneumography with lipiodol. *Surg., Gynec. & Obst.*, Nov., 1928, xlvii, 673–677.

The direct bronchoscopic method for pneumography is emphasized for the following reasons: (1) The invaluable aid afforded by direct inspection of the bronchial tree; (2) the possibility of making a bronchoscopic diagnosis and using vaccine therapy, removing stenosing granulations and aspirating pus from drowned lung and thus allowing more filling of the affected area; (3) if lipiodol has any therapeutic value, it is advisable first to remove secretions and débris to allow lipiodol to have contact with the diseased mucous membrane; (4) as interpretation of roentgenograms is still imperfect and the aid of the bronchoscopic inspection helps in elucidating the roentgenographic and clinical findings.

The indications for the introduction of lipiodol for pneumography are: (*a*) as a general rule in all forms of chronic bronchopulmonary and pleural suppurations in which a differental diagnosis between bronchiectasis, lung abscess, bronchopleural fistula and empyema is required; (*b*) a more accurate differentiation between upper and lower lobe lesions; (*c*) in certain cases of acute lung abscess; (*d*) in lesions of the left lung masked by the cardiac shadow; (*e*) in carefully selected cases of surgical type of pulmonary tuberculosis (*f*) to determine the efficiency of collapse of the lung, and (*g*) and to reveal the cause for persistent signs and symptoms.

The contraindications for the use of lipiodol are the exudative type of pulmonary tuberculosis, advanced bronchopulmonary disease and after recent hemoptysis.

The dangers of bronchoscopy are *nil* in the hands of a gentle, careful and thoroughly trained bronchoscopist. The excessive use of cocaine applied to prevent the incessant cough of the patient should be borne in mind. Iodism from lipiodol has not been observed by the author even in susceptible individuals. Lipiodol is dangerous in acute infections or in acute exacerbations of a chronic process. The author calls attention to the importance of not interpreting erroneously the confusing densities in the lung fields resulting from a previous instillation of lipiodol.

The preparation of the patient, anesthetization, instruments, dosage, and technique of the procedure are also discussed.—*E. P. Pendergrass.*

Bársony, Th. Hiatus hernia. *Förtschr. a. d. Geb. d. Röentgenstrablen*, 1928, xxxviii, 629–641.

The small hiatus herniae have been known in the literature since the description of Åkerlund. Pathologico-anatomically the lesion has not been described as yet.

The small hiatus herniae are recognizable only by means of roentgen examination. Sometimes differential diagnosis from contractions of the esophagus is necessary. A careful observation reveals that the hiatus herniae are by no means infrequent. The mechanism of their formation is not sufficiently known. The hiatus of the esophagus is often dilated in idiopathic esophageal dilatations without there being evidence of a true hernia.

It is very difficult to determine the size of the hernial opening; in case of very large herniae it is impossible to determine the position of the cardia. The portion of the stomach entering the hernia shows great variations even during examination. The clinical importance of the small hiatus hernia is not sufficiently known.—*T. Leucutia.*

Béclère, Claude, Darbois and Ledoux-Lebard. Roentgen diagnosis of uterine fibromyomas. *J. de radiol. d'électrol.*, Jan., 1929, xiii, 1–22.

The injection of intrauterine lipiodol for the diagnosis of fibromyomas is important since it permits a differential diagnosis in many obscure cases and since it allows certain conclusions to be drawn as to the best method of treatment to be followed.

Technique. The usual technique is employed by injecting the lipiodol through a cannula under control of the pressure by a manometer and by observing the progression of the injected lipiodol roentgenoscopically. Roentgenograms are taken at intervals in both anteroposterior and lateral positions. The authors insist especially on the encircling of the tumor as palpated on the anterior surface of the abdominal wall by a lead wire (placed on the skin of the abdomen) so as to permit the estimation of the relationship of the injected uterine cavity to the contour of the outlined tumor. The roentgenogram in this case should be taken from underneath with the film placed on the abdominal wall so as to produce the least distortion of the wire on the film.

Diagnostic Signs. The most important positive diagnostic sign is the change in size of the uterine cavity which may be enlarged, normal or diminished. If the fibromyoma is single the uterine cavity as a rule is enlarged and deformed in the shape of a crescent. If the tumors are multiple the uterine cavity is enlarged and deformed without any definite regularity. In instances, the presence of calcification within the tumor area strengthens the diagnosis. In the double fibromas if they are of the submucous type there is usually a diminution in the cavity of the uterus, while in the subserous type the uterine cavity may be entirely negative.

The differential diagnosis includes pregnancy and cysts. The differentiation from pregnancy is often impossible. However, the authors are of the opinion that if there is any clinical evidence of pregnancy the lipiodol injection should be omitted, even in the doubtful cases. The differentiation from cysts is made possible by encircling the tumor by the lead wire. If the injected uterine cavity appears at the periphery of the circle the condition is due to a cyst which in the majority of the cases is an ovarian cyst and less frequently an intraligmental cyst. If the uterine cavity is in the center of the lead wire circle it is advisable to take a roentgenogram also in the lateral view in order to detect an anterior or posterior displacement of the uterus. Occasionally the visualization of teeth within the tumor area may aid in establishing the diagnosis of a dermoid cyst.

Diagnosis of Complications. A fibroma treated by roentgen therapy may start to bleed again for the following reasons: (1) slight bleeding at the completion of the treatment or shortly afterwards, indicating a slow regression of a submucous fibroma; (2) hemorrhages associated with brusk disappearance of the hot flashes, indicating a return of ovarian function; (3) reappearance of metrorrhagias several years following the completion of roentgen therapy, indicating possibility of malignancy. The use of lipiodol may be of considerable aid in the establishment of a precise diagnosis in such instances. This is especially true with regard to neoplasms.

Therapeutic Indications. (1) In case of cyst, surgical intervention is the method of procedure; (2) in case of fibroma both surgery and irradiation may be used. Myomectomy would be of course the ideal method. This is advocated especially if the fibroma is subserous or pedunculated and if there is a patency of the tubes; otherwise irradiation is indicated; (3) in the presence of a neoplasm of the body of the uterus complete hysterectomy should be done.—*T. Leucutia.*

Bird, Clarence E. Tumors which may expand the curvature of the duodenum, particularly tumors and infections of the retroperitoneal lymph nodes. *Ann. Surg.*, Jan., 1929, lxxxix, 12–29.

The author's purpose in this paper is to

call attention to certain lesions of the upper abdomen, which as shown by the roentgen ray, serve to expand the normal duodenal curvature, and to point out the bearing of the deformity on proper treatment. He collected 6 cases from the records of the Peter Bent Brigham Hospital, all of which showed this positive roentgen finding. In the first case the roentgenologist's report showed a dilated and atonic stomach with a narrow antrum which was displaced upward, and the greater curvature showed irregularities, suggesting extrinsic pressure rather than intrinsic deformity. The duodenal cap could not be definitely outlined, but the duodenal loop was expanded into a large circle surrounding the palpable mass in the epigastrium. This patient, after operation and deep roentgen therapy over the mass found at operation, eventually died and autopsy showed a retroperitoneal erythrocytoma, which had been absorbed by irradiation.

In all the other cases the reports of the roentgen examination showed the duodenum forming a circle around the suspected mass, or stretched around the mass. In some of the cases, large filling defects were observed on the greater curvature, as in the first case evidently being caused by extrinsic pressure.

The tumors that cause an expansion of the duodenal arc can be grouped readily into (1) lesions originating outside of the pancreas, and (2) those arising within the pancreas itself. In the series of 6 cases, the 3 tumors that caused the greatest expansion of the duodenal arc belonged to the first group, in one case due to an erythrocytoma affecting the lymph nodes, in the second, the expansion was due to a lymphosarcoma, and in the third to carcinoma, metastatic in the lymph nodes, from a malignant tumor of the testicle. Of all the possible extrinsic causes of the expanded curvature of the duodenum, the lymph node tumors and infections, including Hodgkin's disease and tuberculosis, are undoubtedly by far the most common.

Lesions originating within the pancreas itself, apparently produce significant degrees of the deformity far less often. The reason for this is apparent in that the most common lesion of the head of the pancreas, carcinoma, obstructs the common bile duct, dams back the external pancreatic secretion and causes death before the tumor reaches a sufficient size to expand the duodenal curvature. Retroperitoneal sarcoma or tuberculosis is likely to produce a large mass which first displaces the common bile duct but does not occlude it, and consequently causes little or no jaundice, and which second, in growing, expands the duodenal arc into a narrow ribbon around its periphery. Chronic pancreatitis, the second most common disease, can occasionally expand the arc by inflammatory infiltration of the pancreatic tissues and by the formation of cystic collections of fluid. These, however, are not common, and occur more often in the body of the organ than in the head, in which case they do not result in expansion of the arc. The roentgen diagnosis of lesions arising within the head of the pancreas is thus uncommon except in the case of large cysts.

Expansion of the curve must be quite marked before it can be considered definitely pathological by roentgen examination. The expansion can be determined during the course of the usual gastrointestinal roentgen examination provided the duodenum is made to fill by pressure exerted against the abdominal mass with the patient in the right prone position. Temporary obstruction of the duodenum by abdominal compression of the third portion against the spine, with the patient in the right prone position, will usually visualize the expanded arc (the method of Chaoul).

The author believes that if there is any doubt as to the pathological nature of a tumor causing an expansion of the duodenal arc, even though the mass should be associated with partial intestinal obstruction or jaundice, operation should be withheld until the effect of irradiation has been determined, for many of the lesions producing such deformity are favorably affected by irradiation, thereby making operation unnecessary.

The article includes an excellent tabulation, on an anatomical basis, of all possible tumors affecting the pancreas in such manner as to cause this characteristic deformity of the duodenum, and in addition, contains an excellent review of the literature, with a voluminous bibliography.—*R. S. Bromer.*

COTTALORDA, J. Depression fractures of the cotyloid cavity. *Presse méd.*, March 23, 1929, xxxvii, 388–390.

Based on a series of 107 cases collected since 1922, the author studied the clinical and roentgenologic appearance of fractures of the acetabulum producing a depression of the fragments into the pelvis.

The most important clinical signs are either physical (rotation and shortening of the lower extremity, flattening of the greater trochanter, ecchymoses, etc.), or functional (functional impotence and spontaneous pain).

Occasionally crepitation, abdominal tumefaction and flaccidity of the fascia lata are observed.

According to the roentgen appearance the fractures are divided into three groups: (*a*) fracture without irruption, the acetabular fossa being fractured but without displacement of the bone fragments; (*b*) fracture with partial irruption, there being displacement of the bone fragments into the pelvis, and (*c*) fracture with total irruption, there being a caving in of the femoral head through the acetabular fossa into the pelvis.

The prognosis of the fractures of the cotyloid cavity is rather bad. Of the 86 cases followed up there was healing in 27 cases (31.3 per cent), ankylosis in 35 cases (40.6 per cent) and death in 24 cases (27.9 per cent). —*T. Leucutia.*

Desplats, R., and D'Hour, H. Calcification of the pericardium. *J. de radiol. et d'électrol.*, Jan., 1929, xiii, 45–46.

A calcification of the pericardium was accidentally discovered in a man seventy-one years of age suffering from pulmonary congestion. After a treatment with digitalis lasting over a period of ten days the pulmonary congestion cleared up and the patient returned to normal life, indicating that the calcification of the pericardium does not result in cardiac insufficiency.—*T. Leucutia.*

Eckman, P. F. Acute perforation of ulcer following barium filling in routine gastrointestinal examination. *Surg., Gynec. & Obst.*, Dec., 1928, xlvii, 858–860.

Eckman feels that occasionally the roentgenoscopic examination of the gastrointestinal tract is attended with danger. In their records they found 5 cases out of approximately 4500 examinations in the last few years in which a perforation occurred, 2 of these resulting fatally.

In Case I, the roentgenoscopic examination was negative, but the patient developed acute abdominal pain a few hours after the examination and at operation was found to have a perforated gastric ulcer on the posterior wall. The patient recovered.

In Case II, a chronic duodenal ulcer was diagnosed. The patient developed signs of perforation several hours later. He was operated upon and made an uneventful recovery.

Case III had extreme pylorospasm and it was necessary to use atropine and some force to visualize the duodenal cap. The patient developed symptoms of perforation on the way home, but was not operated on until eighteen to twenty hours later. The abdomen contained gastric contents and barium. The patient died three days later.

Case IV was a patient in the hospital, and by roentgenoscopic examination he was found to have a duodenal ulcer. Three hours after the examination, he developed a perforation and was operated upon. The patient developed a pneumonia on the third postoperative day and died six days later.

Case V had a roentgenoscopic examination for duodenal ulcer. Thirty-six hours later he developed signs of duodenal perforation, which was confirmed by operation. The patient recovered.

The author believes that the following signs and history should contraindicate roentgen examination: (1) Evidence of bleeding; (2) increasing severity of distress; (3) tenderness and rigidity, and (4) failure of food to relieve as promptly and completely as previously.

Four of the above patients were between the ages of thirty-four and thirty-eight, and one was forty-six years of age. Four of the lesions were duodenal and one gastric.—*E. P. Pendergrass.*

Engels, Herm. Hiatus hernia of the cardiac antrum? *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, xxxviii, 500–508.

A differential diagnosis between a hiatus hernia and an esophageal diverticulum is sometimes impossible (Haenisch). The question is further complicated if the hernia is produced by the antrum of the stomach.

The author describes a case of a hiatus hernia where all signs pointed to the fact that the cardiac portion of the stomach was responsible in producing this condition. A roentgenogram of the chest showed a sac-like shadow in the region of the right phrenocardiac angle about 7.5 cm. long and 4.5 cm. wide with increased transparency. On administration of the barium meal the sac proved to be part of the cardiac end of the stomach. Peristaltic movements as well as rugae could be observed plainly.

The paucity of the clinical symptoms (the lesion was discovered accidentally) indicates a congenital anomaly.—*T. Leucutia.*

Finochietto, Ricardo, and Schlanger, Pablo. Mesocolon transversum breve. *Arch. f. klin. Chir.*, 1929, cliv, 129–141.

Six cases of unusual shortness of the transverse mesocolon are described, resulting in different deformities of the colon. The roentgen findings were those of a dilatation, hyperperistalsis and hypermotility of the stomach, associated with a dilatation of the second portion of the duodenum and delay of duodenal emptying due

to a pressure of the shortened mesocolon (duodenal ileus). The barium-filled colon showed in the majority of instances an unusually high position, in some instances including the entire colon (mesocolon breve totale) and others extending over only parts of the colon (mesocolon breve partiale). In order to evaluate the position of the colon as compared to the position of the stomach it is advised that the administration of the barium meal be repeated the next day during the examination of the colon.

Occasionally a symptomatic mesocolon breve is observed secondary to shortening of the mesenterium due to induration such as, for example, following carcinoma or inflammation of the mesocolon. One may differentiate therefore between a congenital mesocolon and a symptomatic mesocolon, this latter being temporary (infiltration due to inflammation) or permanent (carcinoma).—*T. Leucutia.*

GARLAND, JOSEPH. Some sidelights on the thymus vogue. *N. England J. M.*, Jan. 10, 1929, cc, 59–63.

Pediatrists and roentgenologists have "caused the thymus to cast a shadow upon the land." Medical men are confused as to the difference between simple hyperplasia of the thymus and the so-called status thymicolymphaticus, or status lymphaticus. When individuals with a roentgenologically demonstrated enlargement of the thymus die suddenly or during anesthesia, they are usually said to have died a "thymic death."

The simple presence of an enlarged thymus may cause such symptons as brassy cough, noisy respiration, and cyanosis, but status lymphaticus exhibits general hypertrophy of all lymphoid tissue. The thymus gland in man arises as a paired ventral outgrowth (entodermic) of the 3d and 4th branchial clefts. It contains lymphocytic and epithelial cells. Enlargement of the thymus occurs frequently in Addison's disease, acromegaly, and eunuchoidism, and in 75 to 95 per cent of the cases of exophthalmic goiter.

The first supposed thymic death was described in 1614 by Felix Plater. Hammar has made the best studies on the size of the thymus. He gives the normal weight from six to ten years, as 13.26 gm., from twenty-one to twenty-five years as 37.52 gm., and from fifty-five to sixty-five years as 16.08 gm. MacCallum describes status lymphaticus as a general constitutional abnormality with physical inferiority. There is lack of development of the secondary sex characteristics, also general enlargement of the lymphoid tissue. Boyd (1927) says the size of the thymus depends largely upon the child's state of nutrition and does not consider the enlarged thymus as a source of danger. She finds that it does not begin to increase in size until after the first two weeks of life and thinks that hoarseness, inspiratory stridor and crowing suggest irritation of the recurrent laryngeal nerve. She considers that the anatomic picture called status lymphaticus represents the normal thymus and lymphatic tissue of a well-nourished child. Autopsy weights of the thymus are as follows: birth, 13 gm., 6 months 20 gm., 13 years, 35 gm., in well-nourished children. In poorly nourished children, the weights are as follows: 6 months, 6 gm., 13 years, 13 gm. Wasson notes that roentgenologically small thin infants have small thymic shadows, and well-nourished, fat babies have moderate or large shadows of the thymus. Pfahler considers the roentgenogram the most reliable means of thymus diagnosis at present, and radiation therapy as specific for thymic enlargement. Perkins advocates routine roentgen examination of all children before surgical procedures.

Various other observers have described anteroposterior enlargement of the thymus, wide, flattened glands, and the resemblance of lymphadenitis of the upper mediastinum to enlarged thymus. The thymus obsession is usually based solely on the roentgenogram. There are no accepted standards of normal and abnormal size as shown on the films. Furthermore roentgenograms of the chest will not disclose the widespread changes that occur in status lymphaticus. McLean and Sullivan suggest acute suprarenal insufficiency as the cause of death in so-called status thymicolymphaticus.

The author has examined the records of 1,564 consecutive autopsies done at the Massachusetts General Hospital between 1917 and 1928. Only 44 of these cases were anatomiclly diagnosed as enlargement of the thymus or status lymphaticus. Of these 44 cases, 21 had thymus glands whose weights were well within the normal limits as now conceived. Therefore only 23 cases had a justifiable diagnosis of thymic enlargement. Nine of these 23 cases were adults, and 8 of them had thyroid disease. The other adult died of pyopneumothorax. Eleven of the 23 cases had major operations from one day to several years preceding death. Only one case died during operation, a sigmoidostomy for intestinal obstruction. Nine of the cases had roentgen examinations of the chest. Two of the 9 showed possible widening of the thymic shadow, the others showed slight changes in the cardiac silhouette or were frankly negative.

Four cases might possibly have died from status lymphaticus, but each of these had other pathological conditions that were easily capable of producing death.

Garland feels that roentgen examination of all patients with radiation treatment of all cases showing demonstrable thymic shadows is not justified.—*R. S. Bromer.*

GIAVOTTO, G. The roentgenologic exploration in gynecology by means of lipiodol. *Folia gynaec.*, 1928, xxv, 257–291.

The author, continuing the researches of Vercesi begun in 1924, has used the injection of lipiodol for the study of pelvic organs in 56 cases. The investigations were carried out mostly in cases of salpingoophoritis.

The injection was done in the usual way with Cotte's apparatus and under the control of a manometer. In 28 cases the roentgen findings were controlled by operative intervention.

Indications. (1) Sterility, both primary and secondary. (2) Suspected adnexal lesions, for a differential diagnosis between ovarian cyst and hydrosalpinx, or ovarian cyst and encapsulated ascites, or ovarian cyst and tubal ovarian cyst, or adnexitis and appendicitis. (3) Chronic adnexitis, for the determination of the occlusion of the tube, location of the occlusion and especially as regards the operative indications (salpingostomy). (4) Uterine fibromas, in order to decide whether or not conservative surgery is indicated. (5) In the differential diagnosis of uterine and parametrial tumors (multiple fibromas and chronic adnexitis or fibroma and old hematocele or uterine fibroma and ovarian tumor). (6) For the control of the results obtained by conservative surgical interventions (salpingostomy, enucleation of uterine fibroids, tubo-uterine conditions after the operation of Portes). (7) In congenital malformations.

Contraindications. (1) Vaginitis, acute cervicitis and all other acute infectious conditions of the genital canal. (2) Fever or other severe conditions found at the time of the examination. (3) Menstruation or metrorrhagia. (4) Pregnancy. The author is aware of Heuser's claim with regard to the innocuousness of the method in doubtful cases of pregnancy but he believes that one should proceed as cautiously as possible. The conclusion is reached that the injection of lipiodol, if performed aseptically, is harmless and has great diagnostic value. It is advisable that roentgenograms be made at various intervals following the injection of the oil.—*T. Leucutia.*

GIAVOTTO, G. Tubal peristalsis: roentgenologic observations. *Folia gynaec.*, 1928, xxv, 293–316.

The author accidentally observed in a case the filling of a tube and the passage of the injected lipiodol into the peritoneal cavity without filling of the uterine cavity. In studying the peristaltic movements of the tube he arrived at the conclusion that the progress of the iodized oil from the uterus into the peritoneal cavity is due to an active contraction of the tube rather than to a pressure from the uterus. This active contraction of the tube is the result of periodic contractions of the sphincter of the uterine angle, which, however, are not always synchronous for the two sides. One may consider the periodic contractions as antiperistaltic movements of the tube.—*T. Leucutia.*

GRYNKRAUT, B. A roentgenoscopic surprise: a misdiagnosed esophago-pulmonary fistula. *J. de radiol. et d'électrol.*, Jan., 1929, xiii, 47–48.

An esophago-pulmonary fistula is described in a man sixty years of age, with a perfect tolerance and entire lack of symptomatology. The condition was discovered accidentally. Since there was evidence of a mediastinal tumor it was assumed that the fistula was associated with this tumor.—*T. Leucutia.*

GUTMANN, RENÉ-A., JAHIEL, RICHARD, and THÉODORESCO, DAN. Postoperative peptic ulcer; clinical and roentgenological diagnosis. *Presse méd.*, March 20, 1929, xxxvii, 378–380.

In a series of over 1000 gastroenterostomies for gastric or duodenal ulcer, 20 cases (1.5 per cent) of recurrent postoperative peptic ulcers were found. These cases were studied in detail especially with regard to the clinical and roentgenological signs.

The most important clinical sign is the exceptionally severe pain (so that the patient is "doubled up"), which shows a rhythmic and periodic character. The rhythmicity is observed in connection with the meals, the pain appearing as a rule within four to five hours following meals. The periodical variation, the reason of which is not sufficiently clear as yet, consists in periods of severe pain (from ten days to one month), separated by intervals entirely free of pain. The longer the duration of the ulcer, the less constant the rhythmicity and periodicity of the pain. Other clinical signs such as localization of the pain, vomiting, melena, etc., are also of considerable importance.

The peptic ulcer if left untreated evolves

into different complications such as jejunocolic fistula, perforation with localized peritonitis, etc. A perforation in the free peritoneum is only exceptionally observed.

The roentgenologic signs consist chiefly in the visualization of a niche in the serial roentgenograms. The niche may appear at the border of the anastomotic loop in the form of a peptic ulcer of the ansa or at the gastric border of the anastomosis in the form of a peptic ulcer of the stoma or finally in any other part of the stomach. In all instances the peptic ulcer may remain undetected, especially if the stomach is filled with barium. The compression of the stomach, the dynamic study of the gastroenterostomy by roentgenoscopy, the rate of gastric evacuation, the permeability of the pylorus, the functioning of the stoma and especially the coördination of the clinical signs with the roentgenologic findings may aid in establishing a correct diagnosis. —*T. Leucutia.*

JAYLE, F., and AIMÉ, PAUL. Choledochography. *Presse méd.*, Feb. 6, 1929, xxxvii, 178–179.

A case is described in which the common duct was outlined by administration of the dye making diagnosis of stones in the common duct possible. The first two attempts were negative and only a third administration of the dye revealed a partial filling of the gallbladder with signs of obstruction produced by the stones in the common duct. It is emphasized that in case of negative roentgen findings but with evidence of positive clinical symptoms the examination be repeated.—*T. Leucutia.*

KARFIOL, GEORG. The course of the epiphyseal line in coxa vara. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1929, xxxix, 326–330.

Hoffa in 1905 described two types of epiphyseal lines in coxa vara, the vertical type, indicating congenital coxa vara and the oblique type, indicating an acquired coxa vara. Very little has been written on this since that time. The author's attention was recently called to the subject by the fact that both types of epiphyseal lines were observed in a patient with bilateral coxa vara. In connection with this a review of all roentgenograms taken during the past few years was made and it was found that there were 26 cases with coxa vara. In 17 there was the oblique type and in 6 the vertical type of epiphyseal line, and in 3 cases (including the one mentioned) there was a combination of both. From this the author thinks that the type of the epiphyseal line only indicates the nature and intensity of the disease but that it cannot be applied for the differentiation of the congenital and acquired form of the coxa vara.—*T. Leucutia.*

ROENTGEN AND RADIUM THERAPY

CADE, STAMFORD. Radium therapy of cancer of the buccal cavity. *Lancet*, Jan. 5, 1929, i, 8–12.

The author states that in carcinoma of the buccal cavity treated by radium, the best results are obtained in early and operable cases. In inoperable cases, the best results are obtained locally. Hopelessly advanced cases, so frequently sent for radium therapy, are beyond the stage where any form of treatment is of value, and cures cannot be expected in such cases. Radium treatment does not always result in a complete disappearance of the growth, and occasionally a local recurrence is seen two or three years after irradiation. In his experience, a second treatment is possible and sometimes gives excellent results.

The treatment of oral neoplasms depends upon the selective action of the gamma rays upon the newly developed cells. Cells in mitosis are more sensitive to irradiation than cells at rest. But it has been shown that the effect of irradiation on the stroma is equally important. His personal observation supports Roussy's statement that a good result may be expected in those cases where the disappearance of mitosis and cellular disintegration is unaccompanied by changes in the stroma.

In the tongue and in the oral cavity, changes due to irradiation can be inspected daily. In a series of 50 cases, a latent period was observed between the time of irradiation and the appearance of changes due to the treatment. This varies in length of time due to various factors. Four types of neoplasms are usually seen in the month: (1) the papillary, (2) the nodular, (3) the ulcerous and (4) the fissured. The degree of malignancy of these groups when considered from the point of view of "excisional surgery" is in the order mentioned. From the point of view of radium therapy, the prognosis is reversed, and the papillary type which is the most malignant, responds most rapidly to irradiation.

Whatever the situation of the neoplasm, its response to irradiation is the same. The results are better in the anterior group owing to the simplicity of technique in this situation. The posterior part of the tongue presents difficulties in approach and the extent of the lesion is easily underestimated. Growths of the inferior aspect of the tongue and the floor of the mouth extend early beyond the intrinsic

muscles of the tongue, which renders treatment difficult. Early lesions of the floor of the mouth give good results.

Three methods of irradiation are used. The interstitial method consists in the introduction of radium salt or radon emanation, screened by platinum, into and around the tumor. The use of platinum needles is the method of choice. The advantages of this method in selected cases, are (1) the possibility of calculating the dose, carefully and accurately, (2) homogeneous irradiation, (3) prolongation of the period of treatment, since normal tissues are protected by the multiplicity of foci and maximum screenage.

The cavitary method is suitable for cases of cancer of the palate, uvula, and certain types of epithelioma of the cheek and lip. A plate, similar to a denture is made for each individual case, and is constructed of vulcanite, stent, or composition, lined with lead, and carries the requisite amount of radium. Continuous or interrupted application is made, and is prolonged until the desired reaction is obtained. This method is only used in preference to the interstitial in cancers of the palate and buccal aspect of the cheek.

Surface application, consisting of the application of radium at a distance of 15 mm., is used for the treatment of secondary cervical deposits. Paste collars, of which the details of preparation are elsewhere published, are made so as to cover the whole or part of the neck.

In primary growths of the tongue, radium needles are introduced, under either local or general anesthesia, the needles being placed in healthy tissue surrounding the lesion. Before introduction, careful, scrupulous toilet of the mouth is carried out, carious teeth are extracted, tartar is scraped and metal fillings are removed. In lesions of the posterodorsal aspect of the tongue, intratracheal anesthesia is employed. Protection of the palate and the alveoli is obtained by means of dental plates lined with lead. For a lesion situated far back on the posterior aspect of the tongue, radon seeds are preferred because of the difficulty of introduction of needles, but from the point of view of uniform intensity, radiation needles are superior to seeds. Needles containing 0.6 mg. and 1.33 mg. of radium are used, screened with 0.5 and 0.6 mm. of platinum. Eight to ten needles as a rule are required, and are left in position seven to nine days. The total dose varies from 800 to 1600 mg.-hr.

The method of choice for lesions of the pillars of the fauces and uvula is irradiation by means of radon seeds, introduced by means of a trocar and cannula, around and behind the growth, regularly distributed at a distance of 1 cm. from each other, and having an initial strength of 1.8 to 1.2 mc. each. These are left in position ten or fourteen days.

For the plate a vulcanite or stent apparatus is made, lined with 1.5 mm. of lead, with a window corresponding to the extent of the lesion, holding needles containing a total of 15 mg. of radium, the latter being covered with vulcanite. This is worn, day and night for ten or fourteen days.

For extensive epitheliomas of the cheek, surface application either internal or external, may be used as an alternative to needling. For a localized epithelioma of the cheek, a plate containing 10 mg. of radium is worn for seven to ten days, giving a total dose of 2000—3000 mg-hr.

For operable cases of metastatic involvement of the cervical glands, operation is performed one month after irradiation of the primary growth. Three weeks after operation, needles are used, inserted in a paste collar. In inoperable cases huge doses, amounting to 25,000 to 30,000 mg-hr. are used, the reaction aimed at being severe, and palliative results are obtained where no other form of treatment is possible.—*R. S. Bromer.*

CUSHING, HARVEY.] Electro-surgery as an aid to the removal of intracranial tumors. *Surg., Gynec. & Obst.*, Dec., 1928, xlvii, 751–784.

This new electro-surgical unit of Bovie is briefly described, its chief value being in making available in one piece of apparatus different types of currents used in electro-surgery which are in terms of the effects they produce on the tissues as follows: (1) superficial dehydration; (2) cutting; (3) tissue coagulation.

Notable progress has been made in brain surgery, the transformation being due to improvement in operative technique, a better understanding of the cerebrospinal fluid circulation, improvement in diagnostic procedures and the better understanding of tumor histogenesis.

The appropriate treatment of a brain tumor depends upon many factors, but the ideal is extirpation of the lesion at one sitting if possible, and in accomplishing this the control of the bleeding is paramount. The Bovie apparatus for bloodless removal of tumor tissue has largely revolutionized brain surgery, and its possibilities thus far are recorded.

The author discusses some of his early unhappy experiences and how they have been rectified. The explosion of the ether anesthetic, production of Jacksonian convulsions during the application of the high frequency current,

the production of a second degree electrical burn and the electrical shock of the operator are some of the dangers stressed.

In discussing meningiomas the author states that although these tumors are the most benign of all intracranial tumors, they often attain a huge size, they are often very vascular, and are often attached to one or another of the dural sinuses. They arise frequently from an inaccessible portion of the brain and even when more favorably situated, their successful removal is attended by cerebral edema that delays convalescence. The author discusses at length 6 cases in which the new method of removal was tried. For those interested this abstract should not suffice but the case histories should be studied. Briefly, the author removes the major portion of the central part of the tumor and allows their walls to collapse and he was then able to safely dissect the borders of the lesion from the surrounding brain tissues. In the early cases, secondary infection from improper sterilization of the electrodes or from lowered resistance caused by the coagulation of tissues resulted in death in 4 cases out of 39. This difficulty has been overcome.

In treating the highly vascular blood vessel tumors which are actually of angioblastic origin, the author is hopeful of successfully removing early lesions, in the large lesions his success has been such as to make one optimistic. These tumors are invariably found in the cerebellum, some of them being cystic and some solid.

The author describes one case of a successful removal of a *cerebral glioma* (astrocytoma). As a result of their experience and experimentation they now can make transcortical incisions of the brain with comparative bloodlessness.

Cerebellar gliomas which arise from and involve the roof of the fourth ventricle are common lesions especially in children. One successful case is described in detail. Again the author calls attention to the value of the electric scalpel.

The acoustic tumors because of their characteristic symptomatology are possibly the most easily recognized of any intracranial tumors. They are inherently benign. Technically they offer greater difficulties in removal than practically any other tumor. One case is described and in this a new procedure of removing a portion of the cerebellar hemisphere to allow better accessibility to the tumor is described in detail.

Cushing also describes in detail some of the essentials of this type of surgery, and in summarizing the paper feels that in this new piece of apparatus there lie great possibilities which with common use and more knowledge may prove as revolutionary in surgery as antisepsis.—*E. P. Pendergrass.*

Dean, Archie L. Jr. The treatment of teratoid tumors of the testis with radium and the roentgen ray. *J. Urol.*, Jan., 1929, xxi, 83–101.

This article is a statistical study of 124 patients examined and treated at the Memorial Hospital (New York).

Incidence. Thirty-four per cent of the patients were between twenty and thirty years of age, 42 per cent were between thirty and forty years; 63 per cent were married, and 37 per cent were single. The right testis was involved in 53 per cent, and the left in 47 per cent. In 77 per cent of the cases the involved testis was fully descended; in the abdomen 2.5 per cent, in the inguinal canal in 11 per cent, and unrecorded as to location in 10 per cent. There was a history of definite trauma in 11 per cent of the cases, venereal disease was denied by 77 per cent, gonorrhea was admitted by 15 per cent, and syphilis was proven in 4 per cent.

Pathology. Ewing's original classification of teratomas is used. These tumors usually arise from sex cells in or near the rete testis which are able to develop tissues representing any of the three germ layers. However, these teratoid tumors usually show some constituent type of tissue which predominates. The most common type consists of embryonal tissue; it develops rapidly and metastasizes early. This type made up 40 per cent of the author's material. The route of metastasis may be: (1) by inguinal adenopathy, which is uncommon; (2) by the spermatic chain of lymphatics and lumber nodes, which is most common, and (3) by metastasis through the dilated veins of the spermatic cord to the liver, lungs, brain, kidneys, and stomach.

Symptomatology. In 92 per cent of the cases, the first symptom was an apparent causeless enlargement of the testis. Other symptoms followed, usually as the cause of metastases. These were found in the abdomen, left supraclavicular fossa, lungs, epigastrium, mediastinum, liver, kidney, spleen, breast and brain, in the order of their frequency.

Diagnosis. Although 43 per cent of the patients sought medical advice within one month from their discovery of the first symptons and 70 per cent within the first six months of the disease, only 11 per cent were free of metastasis or recurrence when admitted to the Memorial Hospital. The conditions resembling teratoid tumors of the testis most closely are: (1) gumma of the testis; (2)

tuberculosis of the epididymis, and (3) hydrocele. Diagnostic points, are as follows: the patient is usually under forty years of age, painless swelling of one testis, the skin of the scrotum is usually not involved, the mass is solid and firm, the epididymis is not usually affected, the testis is ordinarily normal in shape, and the spermatic cord rarely is abnormal on palpation. Abdominal examination for metastases and rectal examination for pelvic extension are indicated. The abdominal metastases are deeply situated, rounded, solid, and immovable. Roentgen examination of the chest for metastases should always be made in suspicious cases.

Treatment. The majority of testicular teratoid tumors are composed of embryonal tissue which is highly malignant. Accordingly surgery alone does not often cure, while irradiation finds it a peculiarly susceptible tumor. The author's routine for a primary tumor about 7 cm. in diameter without metastases is given as follows: (1) radium pack over tumor, 9000 mc-hr., at 6 cm. distance, with 2 mm. brass filter, followed in three or four days by (2) high voltage roentgen rays over the tumor, using 320 ma-min., at 50 cm. distance, with 0.5 mm. Cu and 1 mm. Al as filters. About four weeks later, the tumor is surgically removed. Following the operation, the abdomen on the tumor side is irradiated as follows: (1) radium pack anteriorly, 20,000 mc-hr., at 10 cm. distance, with 2 mm. brass filter, (2) high voltage roentgen rays, anteriorly, using 240 ma-min. at 50 cm. distance, with 0.5 mm. Cu and 1 mm. Al filters. This irradiation is repeated two or three times at intervals of three to four months even when there are no signs of metastasis. When abdominal metastases are present, approximately the same radiation is given and the series are repeated at as short intervals as the patient's skin will permit. At the Memorial Hospital, metastases are never operated upon. No matter how advanced the case, the patient is treated with the combination of radium and high voltage roentgen rays. This therapy has thus far caused no mortality. Pulmonary metastases respond to irradiation as well as other metastases.

Results. (1) Primary operable cases, 13 in number, of which 10, or 79 per cent, are alive and well at intervals after radiation therapy, ranging from twelve months to six years and seven months. Two of these cases who refused operation and were treated by irradiation alone are free of disease.

(2) Primary operable cases, 16 in number; these patients had not been operated upon, but had metastases when admitted. Four, or 25 per cent, are alive and well at intervals after radiation therapy ranging from twelve months to five years and eleven months.

(3) Recurrent operable cases, 3 in number. One was operated upon, 2 were not. All are alive and well at intervals after radiation therapy ranging from three years six months to ten years six months.

(4) Recurrent inoperable cases, 81 in number. Many of these had both inoperable local recurrences and inoperable metastases; 24, or 30 per cent, are alive at intervals ranging from nine months to nine years nine months; 56, or 70 per cent, are dead or lost to record.

(5) Postoperative prophylactic irradiation following orchidectomy was given to 11 patients, none of whom had demonstrable recurrence or metastases. Eight, or 72 per cent, are alive at intervals ranging from one year to ten years two months.

Dean concludes that direct trauma and incomplete descent of the testis predispose to the development of teratoid tumors; that the first symptom is usually a painless swelling of the testis; that the possibility of this type of growth must be kept in mind in the examination of all intrascrotal tumors; that radiation therapy is preferable to surgery alone. In his series of 124 cases treated with radium packs and high voltage roentgen rays, 86 per cent of the 16 operable cases are apparently well and 29 per cent of the 97 inoperable cases. He believes that when the patient has no demonstrable metastases the treatment of choice is irradiation of both tumor mass and abdomen on the same side, followed in four to six weeks by orchidectomy. After operation, several series of irradiation should be given as rapidly as the patient's condition will permit. When metastases are present, he believes that they should not be operated upon, but should be irradiated by radium packs and high voltage roentgen rays.—*R. S. Bromer.*

Drips, Della G., and Ford, Frances A. Irradiation of the ovaries and hypophysis in disturbances of menstruation. *J. Am. M. Ass.*, Nov. 3, 1928, xci, 1358–1364.

The continued study of a group of cases of primary oligmenorrhea and amenorrhea and of menorrhagia has confirmed the impression of an essential ovarian hypoactivity in both conditions.

The occurrence of spontaneous remissions and variable results with all forms of treatment add difficulty to the evaluation of a new method.

Low dosage irradiation of the ovaries or hypophysis (5–10 per cent of the skin erythema dose actually applied to the gland) offers

an additional therapeutic measure in intractable cases. This quantity of rays has been shown to produce no histological changes in these structures. The low dosage irradiation has given a comparatively high percentage of favorable results in view of the severity of symptoms in the cases in which it has been used, and regulation of menstruation, when attained, has continued over a comparatively long period.

In experimental studies, which are still incomplete, an attempt was made to gauge the amount of roentgen rays for application to the ovaries of white rats which might be comparable to low dosage irradiation in the human being. Certain immediate variations in the estrual cycle without disturbance of late regularity were obtained. In most instances fertility was not affected. The second and third generations of the irradiated rats were normal. It was not possible to demonstrate precocious sexual development of immature rats by irradiation of the hypophysis with varying doses.—*R. Golden.*

GÁL, FELIX. Radiation therapy of uterine fibromas and metropathy complicated by inflammatory adnexal disease. *Strahlentherapie*, 1929, xxxi, 556–562.

During the past ten years 737 cases of myoma and 442 cases of metropathies have been irradiated, of which 37 presented inflammatory conditions of the adnexa. Twenty-two of the patients irradiated had inflammation of the adnexa associated with uterine fibroma and 16 cases with metropathy without enlarged uterus. In analyzing the 37 cases irradiated the results obtained were satisfactory in all but 2 cases. The usual techinque for myoma and metropathies was employed. The detailed technique is not given. The conclusion is reached that infection of the adnexa does not constitute a contraindication for treatment of uterine fibromas or metropathies. In case of acute inflammations, however, one should wait until the inflammation has subsided. *T. Leucutia.*

GASSUL, R., and SANDBERG, S. The effect of roentgen rays on tuberculous lung processes. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, xxxviii, 488–499.

The process of local and general reaction following irradiation of tuberculous lesions of the lung is considered. Though the roentgen rays present a nonspecific agent, the reaction produced is more or less specific. In order to study this reaction in all its significance the authors undertook clinical experiments in 100 cases of tuberculosis of the lung with active slowly progressing tertiary, nodular, or nodular-fibrotic lesions. All the cases were kept under preliminary observation for four to five weeks so as to study the regular clinical course of the lesions and especially the reactive processes produced by the normal immunization mechanism of the organism.

The technique of irradiation was as follows: Neo-Intensiv-Reform apparatus, 180 kv. eff., Coolidge tube (4 ma.), 0.5 mm. Zn plus 3 mm. Al filters, skin dose 5 to 10 per cent in 3 to 6 minutes (the total dose during one series never exceeding 80 to 100 per cent S.U.D.); three concentric ports of entry (one anterior one lateral, one posterior) of 400 to 625 sq. cm. each. The treatment was repeated when no reaction appeared or after the reaction produced had subsided.

The following observations were made with regard to the reaction produced: A slight local reaction appeared shortly following the first irradiations manifesting itself in an increase in the numder of râles, prolongation of expiration and crepitation with elevation of temperature from 0.5 to 1.5 degrees and a decrease in the sinking time of the blood corpuscles. After further irradiation following the subsidence of the first reaction, clinical and roentgenological signs of a clearing up of the pathological process appeared. At the same time the temperature dropped to normal, the bacilli disappeared from the sputum and the general symptomatology (cough, expectoration, night sweats, sleeplessness, loss of appetite, etc.) rapidly improved.

In the cases with exudative pneumonic indurations, the first reaction often lasted for a period of one to one and a half months, there being marked aggravation of all subjective symptoms. After the subsidence of the reaction there was only slight and very slow improvement.

The longer the intervals between the treatments, the slighter the reactions produced and the more constant the positive effects of the irradiation. In cases with very small doses the reaction was negligible so that irradiation could be carried out in an ambulatory way.

Since roentgen therapy stimulates normal healing processes, it should be considered as an active factor in the treatment of tuberculous lesions of the lung.—*T. Leucutia.*

HANDLEY, W. SAMPSON, Radiology from a surgeon's standpoint. *Lancet*, Jan. 5, 1929, i, 1–6.

This paper is the Silvanus Thompson Lecture delivered before the Institute of Radiology. The author in his introduction describes his

early experiences with a primitive x-ray set, and notes the progress made in roentgenography and radiation therapy since his initial experience in 1896. His lecture is confined to therapeutic radiology alone, being limited to the diseases which come under the surgeon's eye. Certain non-maligant, but precancerous conditions are first discussed.

Chronic Mastitis. The author is especially interested in this disease, as he believes he was the first to advocate its treatment by the roentgen ray in a paper contributed to the *Practitioner* in April, 1910, and he now feels that roentgen rays have fully established their position as the most effective therapeutic agent for chronic mastitis. A long course of treatment is not required; roentgen rays relieve pain, and the mastitic swellings frequently disappear entirely and the breast returns to normal. Irradiation, however, is ineffectual in the cystic form of the disease, and for this, when it occurs in middle age, operation is often necessary. Roentgen rays may aggravate subacute mastitis, and therefore must be used with great caution in this condition. In acute mastitis they are often contraindicated. Among the large number of cases of chronic mastitis sent for radiation therapy, there are 3 who have developed cancer in the breast during or after the treatment.

Chronic mastitis or duct catarrh, is often a precursor of cancer of the breast, and affects by choice the upper, outer quadrant of the breast. Certain of the main ducts of the breast are choked by masses of shed epithelium, and around these affected ducts there is a newly formed fibrous tissue associated with areas of round cell infiltration. Four clinical danger signals are produced by the contraction of this fibrous tissue, namely, (1) axial deviation of the nipple, (2) retraction of the orifices upon the nipple of one or more of the affected ducts, (3) slight elevation of the nipple, and (4) perhaps slight flattening of the nipple. When these signs appear, although there may be no lump in the breast, the imminent onset of a cancer should be feared. The appearance of white dots upon the nipple is also significant. In cases where these danger signals are present, the author is hopeful that the timely administration of roentgen rays of some penetrative power will avert the development of cancer.

Papillomata. In duct papilloma of the breast he is able to report no success from roentgen treatment. If the papilloma can be localized, removal of the breast can often be averted by the use of buried radium tubes. Multiple papilloma of the colon usually ends in carcinoma and no effective treatment is known.

Three periods of roentgen therapy. Looking back over the history of therapeutic roentgen rays during the past thirty years, three periods can be traced. The first is that of inadequate and tentative dosage, sometimes successful in destroying a primary growth, but rarely averting dissemination. In this period it established its value as a prophylactic of recurrence to a limited extent only. The second period was ushered in by the invention of the Coolidge tube, and the exploitation at Erlangen of the utmost power the tube or the patient could stand. The high hopes inspired by this method have been shattered, and the words of caution uttered by leading British radiologists and especially by Knox, have been fully justified. The third period of roentgen therapy dates from the recognition of the failure of Erlangen methods. The great power of the tube is now used in divided doses, which do not produce vomiting or other undesirable symptoms. These methods are justifying themselves by a progressive increase in the power of roentgen treatment to control and prevent recurrence.

Radium. The discovery of radium made it possible to introduce the focus of radiation within the body, and thus to maximize the dose of radiation received by the diseased area, and to mimimize the dose received by the rest of the body. To secure this advantage of radium a new branch of surgery has arisen, radiosurgery, and this seems likely to supersede surface radium treatment. The most interesting question at present in radiosurgery is the proper therapeutic adjustment of the two variables, the amount of radium buried and the time it is left in. Lazarus Barlow has shown the necessity for prolonging the radiation period so as to cover, if possible, the division of every cell of a malignant mass, and has compared the effects of quantitatively identical gamma-ray bombardment upon squamous and upon columnar epithelium, according as the quantity of radium was large and the time of exposure small, or the quantity of radium was small, and the time of exposure large. For squamous epithelium the prolonged low-intensity treatment was more effective, and clinical observations the author states, have confirmed these results for squamous carcinoma beyond a doubt. Since he has recognized that breast cancer is an intrathoracic disease, he has been burying a line of radium tubes at the time of operation along the line of the internal mammary glands, and the percentage of his cases free from recurrence at the end of three years has gone from 47 to 56.

The stimulating effect of small doses. From his experience, it appears almost a certainty

that very small doses of radiation may exert a stimulating effect upon the cells of a malignant growth. The suggestion is, that if a radium tube is placed for a certain time in a field of tissue already impregnated with isolated and latent carcinoma cells, the field will differentiate itself into three zones: (1) a central circle or zone where the carcinoma cells are destroyed; (2) an inner zone where the carcinoma cells, though not killed are inhibited; (3) an outer zone where the carcinoma cells are stimulated to more rapid growth. In the author's earlier work where he was accustomed to implant the radium tubes in the center of or beneath the palpable or visible nodule of malignant tissue, fresh malignant nodules would often appear in the region immediately around the previously implanted area. To meet this danger he has adopted the plan of encircling the palpable focus of disease by a ring of radium tubes in order to sterilize the zone of microscopic infection, assuming that the fresh nodules appeared because of stimulation by an inadequate dose of radiation of an inappreciable and apparently healthy zone of microscopic invasion around the visible focus of disease. He thinks there has been a tendency to ignore the possible stimulating action of small doses of radiation, partly because of the absence of exact data with regard to it, and partly because of exciting prejudice against a novel method of treatment. If these conclusions be accepted, he believes that a principle of great importance in the treatment of malignant desease by either roentgen rays or radium can be evolved, namely, that a careful endeavor should be made to delimit the area in which cancer cells are likely to be present, and that the periphery of the area thus marked out should be first treated. The treatment of the central part of the area should be reserved to the last. This refers, of course, to the cases in which the whole area affected is too large to be treated at one sitting.

The suggestion is made that radiologists might with advantage oftener visit the wards and the operating theatre, and the surgeon more frequently be found in the roentgen laboratory. Radiologists should take every opportunity of verifying their findings. Do they sufficiently study the pathology of the living (Sir Berkeley Moynihan's phrase) as revealed in the operating theatre in cases which they have previously submitted to roentgen examination?

The study of radiohistology. Correct and precise ideas on the mode and spread of cancer are vital to a therapeutic radiologist. Those parts of pathology that bear upon radiology should be closely studied. Handley's work on the dissemination of cancer by permeation has placed the operative treatment upon a rational basis and has also indicated some conditions of successful radiological treatment. In the microscopic growing edge, previously referred to, the disease spreads after irradiation of the central primary mass, because of the dissemination of the pathological process by permeation in the fascial lymphatic plexus. In one experimental case of recurrent breast cancer, with consent of the patient, Handley placed a line of radium capsules, broken in the middle by an intentional gap, in the presumed situation of the microscopic growing edge, over which the skin appeared quite healthy, and a maximal skin dose was administered. No treatment was applied to any recognizable focus of disease. Opposite the radium barrage, the nodules ceased to spread, while they continued in the subsequent months to advance in the gap left in the radium barrage, and round its ends. Radiation had destroyed or inhibited the microscopic growing edge. This experiment helps prove the spread of cancer by permeation and also has some bearing upon the question of stimulation.

The author ventures to suggest that young radiologists should be encouraged to study the pathological side of radiology, first by the establishment of a museum, in charge of a histologist whose opinion would in the course of years become of decisive value in radiohistological questions, and secondly by the establishment of one or more scholarships in radiohistology. He believes that since the technical equipment of therapeutic radiology has reached such a high degree of power and accuracy, the nation which first places the subject upon a complete pathological foundation will lead the way to fresh triumphs.—*R. S. Bromer.*

Hartmann, H., Aitoff, M., and Fabre, S. Local vaccine therapy of sphacelous cancers of the uterine cervix. *Presse méd.*, March 27, 1929, xxxvii, 401–403.

The sphacelous tissues of advanced carcinomas of the cervix form a very favorable medium for a varied bacterial flora. A surgical intervention or even the application of radium under such conditions may enhance the virulence of the bacteria, leading to severe infections and possibly septicemia.

Muttermilch and Lavedan on the basis of numerous experiments assumed that the most virulent microorganism responsible for infection is the streptococcus and consequently they prepared autogenous vaccines which they have used in the form of local dressings. However, it was soon found that such a treatment had no

influence on the course of the infection—and thus of the carcinoma—and therefore it was discontinued. The authors in reopening the question directed their attention to a diplococcus and they systematically studied the vaginal flora in all ulcerated and sphacelous cancers preliminary to and following the application of radium. The technique used for this purpose was as follows: Sphacelous fragments were taken from the surface of the carcinoma and planted in Petri dishes. At the same time smears were made and stained in the usual way. They were then analyzed with regard to the predominating microorganisms. From the colonies in the Petri dish the microorganisms—which predominated in the smear—were isolated and used for the preparation of a mixed autogenous bouillon vaccine. During the few days necessary for the preparation of the vaccine a mixed bouillon vaccine prepared previously from another patient was used. The technique of the local vaccine therapy was as follows: After a douche with plain water 10 c.c. bouillon vaccine was introduced into the vagina, after which the vagina was plugged with a sterilized gauze tampon. The tampon was left in situ during the night and the next morning it was removed followed by a douche with warm water. The tampon soaked with the vaccine was reapplied the next evening. The procedure was repeated for three consecutive days after which a period of rest for two or three days was given the patient. Then the radium was applied. During the vaginal or uterovaginal insertion of the radium the use of the bouillon vaccine tampon was resumed and this was continued for a period of several days after the conclusion of the radium treatment.

This method has been applied since October, 1928, in 10 cases which are described in detail.

The conclusion is reached that following the local application of an autogenous vaccine there is a rapid clearing up of the infection with disappearance of the sphacelation in carcinomas of the cervix. The combination of the radium and the bouillon vaccine therapy is well supported, there being very little or no reaction. After clearing up of the infectious process there is a rapid healing of the carcinoma with a rapid improvement in the general condition of the patient. Several months following the application of the treatment a total cicatrization of the cancer was observed.

As regards the bacteriology of the vaginal flora, the view is expressed that a gram-positive diplococcus (and not the streptococcus) is the agent responsible for the severe infection and sphacelation. This diplococcus—which is not identified as yet—is the last microorganism to disappear following the application of the vaccine therapy. In the last stages it appears exclusively in the interior of the leucocytes. The amelioration of the general condition of the patient is associated with a marked phagocytosis.

Although the authors do not wish to draw final conclusions as yet they believe that the results already obtained justify the application of the auto-bouillon-vaccine therapy also in other sphacelous cancers (such as cancer of the tongue, bucca, etc.). Such a procedure would lead to more advantageous application of the radium even in cases with the most severe infections.—*T. Leucutia.*

Holzknecht, G. The roentgen therapy of Basedow's disease. *Strahlentherapie*, 1928, xxx, 605–612.

The roentgen therapy of Basedow's disease is based on the principle that the condition is due to a hyperfunction of the thyroid gland. The roentgen rays develop an action on the thyroid cells which is inhibitive and depressive and which results in the reduction of the phenomena due to the hyperfunction. Pordes was the first to call attention to the fact that the first irradiation may produce an excessive incretion of the thyrotoxins similar to that observed at operation. Therefore the first dose should be somewhat milder and only when this is well supported by the patient should subsequent doses be increased. It is advisable that the thymus also be included within the field of irradiation, though the importance played by the thymic gland in the production of Basedow phenomena is not sufficiently clear as yet.

Technique. In most cases, one portal, but, when the thyroid gland is considerably enlarged, two portals (180° angle) are used, the larynx and the lungs being well protected; 150 to 170 kv., 30 to 40 cm. skin target distance, 0.5 mm. heavy filter, ¼ to ⅙ S.U.D. on the surface of the skin. The treatment is repeated at weekly intervals. The duration of the treatment depends on the response of the lesion to the irradiation and on the tolerance of the skin. The often emphasized contention that the skin of hyperthyroid patients is more sensitive to irradiation than normal skin does not correspond to actual facts.

Cures are obtained in 60 per cent of the cases, while in 20 to 30 per cent a temporary improvement is observed. Only about 10 per cent remain refractory to irradiation. These, as a rule, include the fulminant, rapidly progressing cases and the chronic cases with heart complications in neurotic individuals.

With the regard to the response of Basedow's disease to irradiation, the observation is made

that acute cases improve rapidly while chronic cases improve much more slowly, so that one may say that irradiation produces a mirror-like reversal of the process. The improvement is chiefly in the functional symptoms which are more labile (tachycardia, palpitation, loss of weight, irritability, etc.), while the improvement in the anatomic phenomena (exophthalmos, goiter, etc.) is slower.

In comparing roentgen therapy to surgical procedures, one finds that both have a common feature in that they tend to reduce the function of the hyperactive thyroid gland. In doing so surgery seems to have the advantage that removal rapidly relieves the pressure on the neighboring tissues while roentgen therapy seems more advantageous through absence of shock, infection and thrombosis which are serious operative complications, not infrequently resulting in death. The often expressed view that preliminary irradiation leads to adhesions which make subsequent operation more difficult is now disproven.

It is recommended that all cases of Basedow's disease be irradiated first and only the refractory cases be submitted to operation. Exceptions to this are the very acute rapidly progressing cases and the chronic cases with large nodular goiters where operation is indicated from the beginning.—*T. Leucutia.*

Schwarz, G. The roentgen therapy of Basedow's disease. *Strablentberapie*, 1928, xxx, 613–618.

The following two experimental facts are important in establishing the criteria of irradiation: (1) In 1923 Weil found that because of the enormous richness in capillaries the circulation for 100 gm. of the thyroid gland is 500 c.c. blood per minute, while for the same quanity of kidney, for example, it is only 100 c.c. and for the inactive musculature, only 12 c.c. per minute, this indicating that there is enormous incretion of thyrotoxins in the blood. (2) In the same year, Bircher by transplanting particles of the thymus gland of Basedow patients, was able to produce typical Basedow's disease in dogs, this indicating that the thymus gland partakes in the production of thyrotoxin.

According to Mayo and the American school the toxic goiter is divided into two groups: (1) the true Basedow, characterized by struma vasculosa, increase in size of the thyroid gland during the disease, rapid development of all symptoms, exophthalmos, normal blood pressure, and young age (thirty years and less), and (2) the toxic adenoma, characterized by struma nodosa, long duration of the struma, slow development of the symptoms, lack of exophthalmos, increased blood pressure, and advanced age (over fourty-four). The nervous manifestations are identical in the two groups. There is, however, a difference in their response to iodine therapy, the true Basedow showing an improvement and toxic adenoma showing a rapid deterioration following the administration of iodine. In using radiation therapy a combination of irradiation and iodine therapy is contraindicated.

It is very important that the irradiation be carried out with very mild doses. A treatment is considered unsuccessful only after a repeated irradiation over a period of at least four months has failed to produce even a temporary improvement.

There are two important points in connection with response to irradiation: (1) The cures, if such are produced, are always of a permanent nature (the author has observed a case with cure lasting now for a period of over nineteen years); (2) an immediate response depends on the duration of the disease previous to the treatment, acute cases responding more readily, and chronic cases more slowly.

There are three objections by surgeons to the irradiation of Basedow's disease: (1) the production of adhesions; (2) operation results more quickly in a complete cure; (3) the continuation of roentgen therapy over a certain length of time is apt to result in a permanent damage to the heart, thus making an operation impossible.

The following answers may be given to the above objections: (1) Irradiation of the thyroid gland with doses such as applied in the treatment of Basedow's disease does not produce adhesions. Even Eiselsberg, who was the first to consider adhesions as a post-irradiation complication, on the basis of more recent observations disregards this as irrelevant. (2) If one figures two weeks as the postoperative period and six weeks as the convalescent period, the time required for a surgical cure corresponds to the time of healing observed following irradiation. (3) Not one case is found in the literature proving that prolongation of the irradiation resulted in unnecessary damage to the muscles of the heart.

It is therefore advised that all cases be treated by irradiation first and that only refractory cases be sent for operation.—*T. Leucutia.*

Pordes, Fritz. The oligosymptomatic thyrotoxicoses and their treatment by roentgen rays. *Strablentberapie*, 1928, xxx, 619–633.

The monosymptomatic thyrotoxicoses represent forms of Basedow's disease with one sym-

ptom predominating (exophthalmos, struma, etc.); they are also called "forme fruste" by Charcot or "Basedowoid" by Stern.

The oligosymptomatic thyrotoxicoses include cases in which the symptomatology is so mild that diagnosis is often impossible. These cases may be divided into two groups: (1) borderline cases, where there is no direct evidence of exophthalmos but where there is a prominence of the eyeballs with a slight enlargement of the thyroid gland, some tremor and increased respiration; (2) latent thyrotoxicosis, a sort of pseudotuberculosis showing a subfebrile state with occasional elevation of temperature, loss of weight, general debility and occasionally signs of beginning apical tuberculosis. The nervous thyrotoxicosis observed at the climacteric age should also be included in this group.

In both the monosymptomatic and oligosymptomatic thyrotoxicoses roentgen therapy leads to excellent results. The irradiation is carried out with small doses such as usually applied in inflammatory conditions and by prolonging the intervals between the individual treatments. The technique of irradiation is as follows: One middle field over the thyroid gland with protection of the larynx and the lungs, 2 H (100 R), 5 mm. Al or 0.5 mm. Zn, 35 cm. skin target distance; treatment being repeated at three to four weeks' intervals. The thymic gland is included within the field of irradiation only from the second treatment on. In about 60 per cent of the cases good results are obtained following the second irradiation. In the rest several irradiations are necessary.—*T. Leucutia.*

Gudzent, F. The radium therapy of Basedow's disease. *Strahlentherapie*, 1928, xxx, 634–643.

The author has used radium therapy for the treatment of Basedow's disease since 1913. The technique is as follows: 100 mg. radium element divided into six tubes of 2 cm. length with 1.5 mm. brass filter, each tube being placed on a cork or rubber plaque 1 cm. thick. A thin layer of cotton is placed over the skin and the six plaques are then placed over the region of the thyroid gland for a period of twenty-four hours. This corresponds to about three-fourths of an erythema dose. The treatment is sometimes repeated ten weeks later.

A total of 244 patients were treated of which 188 were followed up. The cases are divided into four groups: (1) struma; (2) struma basedowificata; (3) Basedow's disease; (4) thyrotoxicosis. The cures for the different groups were: (1) 43.5 per cent; (2) 53 per cent; (3) 64 per cent, and (4) 54 per cent, while the improvements were: (1) 40 per cent; (2) 38 per cent; (3) 36 per cent, and (4) 36 per cent. The healing process following the application of radium is slow, sometimes extending over a period of many months.

It is advised that every patient be irradiated first and only if proven refractory to irradiation be submitted to operation. The author prefers radium to roentgen rays because of the better quality of radiation and because of the milder post-irradiation reactions.—*T. Leucutia.*

MISCELLANEOUS

Dessauer, Friedrich. On the question of the fundamental biological effect of radiation. *Strahlentherapie*, 1928, xxx, 506–518.

In 1922 the author advanced the "point heat" theory as the most plausible hypothesis for the explanation of the biological effect of rays of short wave length. Since then the theory has been endorsed by Simons, Crowther and others. However, there was great opposition from the supporters of the theory of specific "photochemical action" of the radiation. New experiments were therefore necessary in order to elucidate certain not sufficiently clear phases of the phenomena observed in connection with the "point heat" theory. The result of these experiments is given in the present article.

The basic principle of the "point heat" theory as conceived by Dessauer is that the absorbed radiation energy, which is very small and represents only a few gram-calories, cannot act on a biological object by a rise of temperature as a whole since this rise is practically equal to zero, but by a local "heat" or rise of temperature on small discrete "points" where the transformation of radiation and electronic energy occurs. The absorbed roentgen rays, gamma rays and short wave light rays in the transformation of their energy release electrons which, shooting off with various velocities, suffer by traveling through matter a diminution of velocity which leads to deposition of energy at the discrete "points" where the diminution of velocity occurred.

A further step in this theory—and this forms the basis of the new investigations—is the introduction of the principle that large molecules, especially the albumin molecules, play an important part in biological reactions. That such albumin molecules must react whenever energy is deposited on one or more "points" of their structure by the loss of velocity of the impinging electrons is evident. The difference between the "point heat" theory and the theory of "photochemical action" is that the latter assumes that the reaction produced within the molecules is a specific one, that is,

there is a close relationship between the amount of energy deposited and the physical and chemical re-arrangement such as observed in photochemical reactions (Holthusen), while the "point heat" theory assumes that the reaction is nonspecific and consequently of a generalized character, that is, if the energy deposited in the albumin molecule has reached a certain limit a general reaction of the albumin molecules sets in which might be called denaturation (a sort of physico-chemical change). This nonspecific action is somewhat similar to the production of heat: the electrons because of their very small mass cannot set in motion during the process of bombardment atoms or molecules, especially such large molecules as the albumin molecules, but by the indirect action of producing a re-arrangement of the electrons within the atoms or molecules bombarded they may lead to a collison of these atoms or molecules. Through this collision cathode rays are then produced, followed by a rise in temperature. Large molecules form a condition sine qua non of this phenomenon.

Such a conception of the problem incites a number of experiments. Since a denaturation of the albumin molecule results in an enlargement of the molecule, the enlarged molecule is made visible in the ultramicroscope by the Brownian movement. A study of the rhythm of the appearance and disappearance of the visible molecules will permit then certain conclusions with regard to the cause and the relationship between cause and effect.

The experiments were carried out first by Nakashima, later by Rajewsky and Schwerin. A 0.01 per cent pure albumin solution (pseudoglobulin) was studied under the ultramicroscope first with regard to the number of the visible particles in fresh normal solutions (within the first 100 hours), second, following irradiation with various rays of short wave length. It was found that there is an increase in the number of the visible particles following irradiation, this increase appearing in the form of periodical maximum values. A detailed analysis of the periodicity revealed that first there is a latent period, then the gradual development of the maximum value, followed by a gradual fading off. The phenomenon repeats itself at definite intervals until the irradiation is interrupted, after which there is a slow wave-like dying off of the process (lasting for a period of several hours). The duration of a period depends on the concentration of the solution, the dose of radiation applied and the temperature of the solution. All observations point to the fact that the reaction of the albumin molecules toward irradiation consists of two components: (1) the formation of particles (denaturation of the molecules), and (2) the visualization of the particles (coagulation). The second component is the result of molecular motion and thus the seat of a great positive temperature coefficient.

In another series the experiments of Nakashima with regard to the analogy of the heat effect and irradiation effect on the collodial albumin solution were repeated, and it was found that the warming up (approaching the coagulation temperature) of the albumin solution during the irradiation resulted in an increase of both the number and velocity of the particles, a phenomenon which cannot be explained purely on the assumption of increased frequency of collision of denaturized particles. It is more probable that the smaller energy deposits do not suffice in an albumin solution of normal temperature to produce the "point heat" effect but that by warming up the albumin solution a sensitization and thus a lowering of the level of the reaction is brought about. This observation speaks against the photochemical conception of the radiation effect since it is well known that photochemical reactions possess no temperature factors, that is, they are independent of the temperature at which the reaction takes place.

Finally, the experiments were repeated with ultraviolet rays of various wave length (from 320$\mu\mu$ to the shortest wave length) and the same observations were made. This clears up the discrepancies in the investigations of Sonne on the one side and of Hausser and Vahle on the other, proving that there is a complete analogy between the albumin reaction and the erythema formation by irradiation.—*T. Leucutia.*

GARTENMEISTER, RICHARD. The present status of technique in stereoroentgenoscopy. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, xxxviii, 887–894.

A stereoscopic impression can be obtained in roentgenoscopy by separating the two stereoscopic images either in space or in time. In the first instance, the image projected is too small and the distance obtained in the stereoscope too great. Therefore stereoroentgenoscopy by means of two images separated in space is of little practical value.

Stereoroentgenoscopy by means of separation of the images in time has the disadvantages that the luminescence of the screen is too slight and that it is followed by a fluorescence of the screen. It seems therefore

that the invention of a new screen of a stronger luminescence and without after-fluorescence would be the solution to the problem.—*T. Leucutia.*

Gassul, R., and Polakov, A. The biochemical radiation effect upon proteolytic and other processes in vivo and in vitro. *Strahlentherapie*, 1928, xxx, 519–526.

The authors studied in a series of experiments the fermentative processes, especially proteolysis, produced by the influence of radiation. Fifty-six cat spleens were exposed to different doses of roentgen rays and the proteolytic processes observed. Under chloroform narcosis the spleen was extirpated and divided into three parts and placed in flasks with 10 c.c. Ringer's solution and a few drops of toluol. Two of the flasks were irradiated and one served as control. Following the irradiation the tissue was macerated and mixed with 40 c.c. Ringer's solution and then examined for proteolysis one, two, six, twelve, twenty-four hours, and two, four, eight and fourteen days later by using the Bach test. The technique of the irradiation was: 35 to 30 cm. spark gap, 30 cm. target distance, gas tube, 2 to 3 ma., no filters, 10 to 85 min.

In a first series of experiments it was found that there is an inhibition or a total lack of proteolysis following the irradiation with large doses.

A second series of experiments carried out with the irradiation of 3 per cent pepsin in vitro gave identical results: the irradiation with large doses injures or entirely destroys the pepsin ferment.

In a third series of experiments the irradiation was done with smaller doses. It was found that in contradistinction to the large doses, smaller doses produce a temporary activation of the ferment. From this the authors deduce that the irradiation with smaller doses—such as advocated by Holzknecht—may lead to a similar activation of the fermentative processes also in cancer, a factor which is very important from the therapeutic standpoint of cancer.

In a fourth series of experiments the blood of rabbits was examined for cholesterol following irradiation. These experiments proved negative; that is, there was no change in the cholesterol content of the blood following irradiation.—*T. Leucutia.*

Gawalowski, Karel. Comparison of the French and German R unit for radiations and filters such as used in dermatology. *Strahlentherapie*, 1928, xxx, 575–578.

Measurements were carried out with the Solomon ionization chamber and the Siemens dosimeter and the value of the R was determined for the different more or less standard radiations applied in skin therapy. The ratio between R (French) and R (German) for 145 kv. and different filters (1, 2, and 4 mm. Al and 0.15 mm. Zn plus 1 mm. Al) is on an average 2.5.—*T. Leucutia.*

Gilbert, R., and Eghiayan, A. Contribution to a study of the changes of roentgen menopause; a comparsion with the changes of surgical menopause. *Acta radiol.*, 1928, ix, 411–433.

The artificial menopause produced by roentgen therapy and by surgical procedures is analyzed with regard to the qualitative and quantitative changes.

Discussing the manifold terminology used in connection with artificial menopause produced by the roentgen ray, the authors point out that "roentgen castration," since it does not convey all the characteristics of the roentgen menopause, is not a correct term, but that exovulation, desovulation, ovonecrosis (as advised by Seitz and Wintz), roentgen sterilization (Schwarz) or roentgen menopause (Fuchs) are preferable.

In taking into consideration the dose administered, one may produce a temporary menopause when only a part of the follicles are destroyed, a permanent menopause when all follicles are destroyed, and a total castration when, in addition to the follicles, the interstitial gland is also destroyed.

The authors analyze 50 cases of artificial menopause produced by roentgen rays and compare the different qualitative and quantitative changes observed with those of surgical menopause as collected from the literature. The age of the 50 patients was between twenty-six and fifty-five, with a majority between forty-one and fifty. The roentgen treatment applied was chiefly for uterine fibromas. The technique of roentgen therapy was as follows: 4 portals of entry (2 ventral and 2 dorsal) of 100 to 150 sq. cm.; 30 to 40 cm. skin target distance, 1300 to 1500 French R being administered over each field in two sittings, by using 200 kv., 4 ma, 0.5 mm. Zn plus 1 mm. Al, the depth dose varying between 32 and 35 per cent.

The statistical results were analyzed for the following four groups: Group I. Bilateral ovariectomy. Group II. Bilateral ovariectomy with hysterectomy. Group III. Hysterectomy. Group IV. Roentgen therapy.

The following changes were observed: (1) Circulatory changes. (*a*) Hot flashes, with or without perspiration. (The figures obtained

for the different groups were: I—3–97.5 per cent; II—65.8–100 per cent; III—33.33–81 per cent; IV—11.83–91.2 per cent.) The impression is that hot flashes are more pronounced in artificial menopause produced either by bilateral ovariectomy, by ovariectomy and hysterectomy and by roentgen therapy than by hysterectomy alone. (*b*) Hypertension. The figures with regard to the quantitative changes in hypertension are rather confusing and contradictory. The authors examined the blood pressure systematically in 18 patients for a period of several months and arrived at the conclusion that in roentgen menopause, the changes produced in blood pressure are negligible.

(2) Adiposity. (I—17.5–70 per cent; II—38.5 per cent; III—3.33–53.7 per cent; IV—4.65–20 per cent.) Adiposity is pronounced following all types of operations, but seldom occurs after roentgen therapy.

(3) Nervous disturbances. (*a*) Headaches. (I—14–69.6 per cent; II—46 per cent; III—14 per cent; IV—8–14 per cent.) (*b*) Neuromuscular asthenia. (I—6–80.4 per cent; II—46 per cent; III—7 per cent; IV—0–4.87 per cent.) The nervous disturbances are practically negligible in cases with roentgen menopause as compared to the figures in surgical menopause.

(4) Psychic disturbances (anxiety, irritability, instability of character, depression, melancholia, etc.). (I—13.5–80 per cent; II—12.5–73 per cent; III—7–34.2 per cent; IV—10–13.6 per cent.) Here also the changes are the least pronounced in roentgen menopause.

(5) Diminution of memory. These changes show similar figures to those of (4).

(6) Changes of sexual sense. (*a*) Libido. (I—36–82 per cent; II—36 per cent; III—27–40 per cent; IV—21.4–50 per cent.) (*b*) Desire. (I—27–77 per cent; II—10 per cent; III—24–50 per cent; IV—45.7 per cent.) Here the changes due to ovariectomy are the most pronounced, while the changes produced by the other operative procedures are similar to those produced by roentgen menopause.

(7) Skin changes: dermatitis, pruritus, fall of hair, hypertrichosis and disturbance of pigmentation. It is shown that in this group the changes produced by the operative procedures exceed those caused by the roentgen ray.

(8) Constipation. The highest percentage of constipation was observed following ovariectomy (65.6 per cent) while in roentgen menopause, constipation occurred in only 24.87 per cent.

Although there is a wide range in the percentages of the above figures as collected from the literature, the authors arrive at the general conclusion that the changes produced following artificial menopause are less frequent and less pronounced after the application of roentgen rays than with surgical procedures. It is probable that the ovarian tissues destroyed by the roentgen ray produce, through their slow resorption, a sort of ovarian auto-opotherapy which, in most cases, lessens or prevents the appearance of menopausal changes such as are observed after radical surgical procedures.

—*T. Leucutia.*

GLOCKER, R., and GRAF, L. Radiation measurements on roentgen tubes operated by high frequency machines. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, xxxviii, 900–904.

Ionometric measurements carried out by the author with regard to the quality and quantity of the radiation emanating from a tube excited by a high frequency apparatus and a high tension transformer under equal tension and with a filtration of 0.3 mm. Al gave identical values. The calorimetric method (consisting of the measurement of the heating of the anticathode) likewise gave equal values for the radiation energy emanating from the tubes operated by the two methods under identical conditions.

Therefore there is no advantage from the point of view of irradiation in the application of a high frequency machine as a roentgen-ray generator. From the point of view of economy in material and expense and especially transportability the high frequency apparatus is more advantageous.—*T. Leucutia.*

GROEDEL, F. M. Technical perfection of roentgen cinematography. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1929, xxxix, 15–17.

In 1913 the author published a rather complete technique of roentgen cinematography. By making use of the technical improvements since that time, the author recently constructed a new model of roentgen cinematography which has the advantage that the film is run in a much easier way. By this new improvement 16 exposures per second can be taken. The apparatus corresponds to a normal cinematographic camera, with the exception that a film 24 cm. wide is run between two intensifying screens of 18 x 24 cm. dimensions. The intensifying screens are synchronized with the motor driving the film.

Very clear images are obtained by using the following technique: 70 to 80 kv., 100 ma., 2 meter skin target distance, 16 exposures per second. Thus it appears that the problem of roentgen cinematography has been solved.—*T. Leucutia.*

Holthusen, H. Independence of roentgen-ray sensitivity from age of the cell? Observations in epilation. *Strahlentherapie*, 1928, xxxi, 5–15.

Although we have no exact knowledge of the conditions responsible for the radiosensitivity of cells, certain factors influencing the radiosensitivity are well known. Such factors are the increased radiosensiitivty of the cells during mitosis and the great variation of the radiosensitivity during the different generations of the cell. These two factors were well studied in the cells of the reproductive system and were expressed as the Bergonié-Tribondeau law. Recently several phenomena were noted which form an exception to the Bergonié-Tribondeau law. Such a phenomenon is observed in the cells of the hair roots during epilation. The author found that in 3 of his cases a dose which on an unirradiated scalp led to complete epilation, repeated two to three months later for the same purpose has failed to produce even an arrest of the hair growth. This fact cannot be attributed to a hypoallergy but one must surmise that the young hair follicles develop an increased radioresistance, a phenomenon which is a contradiction to the Bergonié-Tribondeau law. In connection with this it is also mentioned that epilation failed to take place at the points where compression was applied on the scalp, most probably because of the anemia of that particular zone produced during the irradiation.—*T. Leucutia.*

Jaeger, Robert. Contribution to the question of standardization of small ionization chambers. *Strahlentherapie*, 1928, xxx, 567–574.

For the practical roentgen dose measurement a small ionization chamber has the greatest advantages but not until recently could the dependence of such chambers on the wave length be entirely eliminated. Fricke and Glasser by theoretically introducing the air wall chamber have paved the way for the construction of new ionization chambers. A series of thimble chambers were recently designed by using the principle of the air wall chambers. For this purpose carbon and some metallic addition were pressed by a new process by Siemens and Halske according to the formula of Fricke and Glasser for the ionization chamber. The chambers so constructed have the following advantages: (1) great mechanical resistance due to marked elasticity of the walls; (2) the metallic conductivity of the material; (3) independence of the radiation quality; (4) absolutely identical construction in that several chambers of the same composition show entirely identical features.—*T. Leucutia.*

Kahlstorf, A. Experimental investigations on the action of fractional roentgen irradiation on *Ascaris* eggs. *Strahlentherapie*, 1928, xxxi, 199–206.

Zuppinger's method was used in preparing the *Ascaris* eggs for the experiments. It was found that fractional irradiation is more effective than massive irradiation. The biological action gradually increases with a division of the dose into two, four and six fractions, from which point on it remains constant. The optimum interval between the fractions is twenty-four hours. A 100 per cent destruction of the eggs cannot be produced by high doses of roentgen rays, not even by administering 20,000 r.—*T. Leucutia.*

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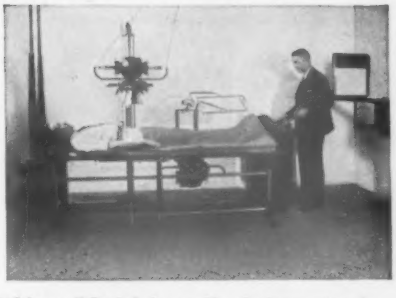

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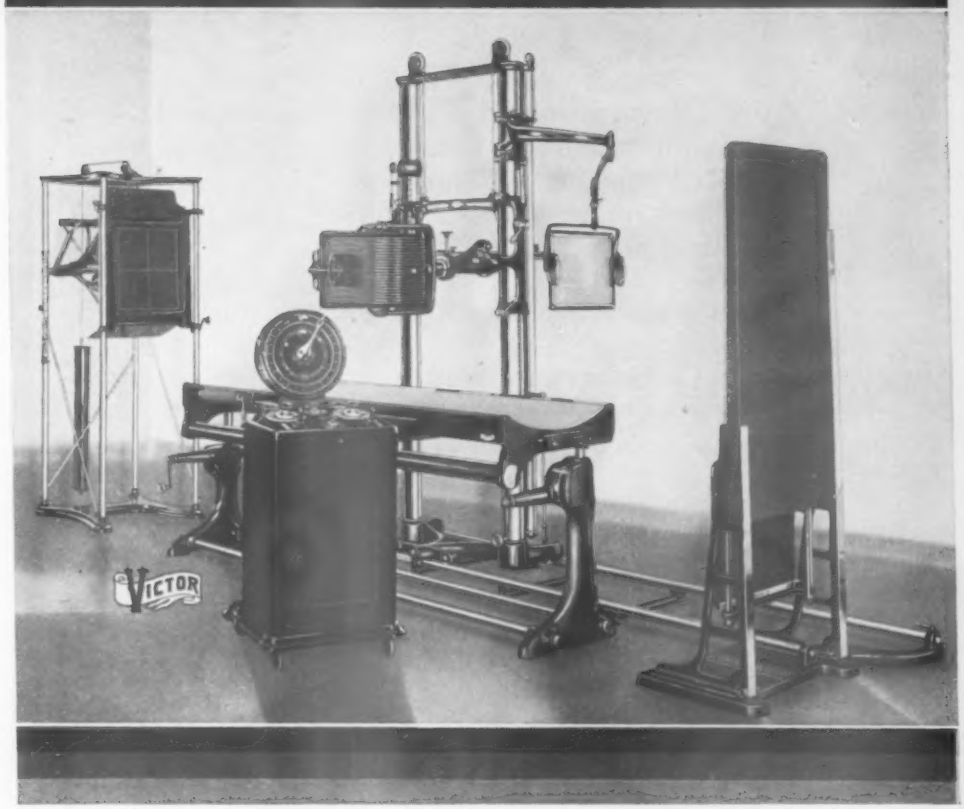

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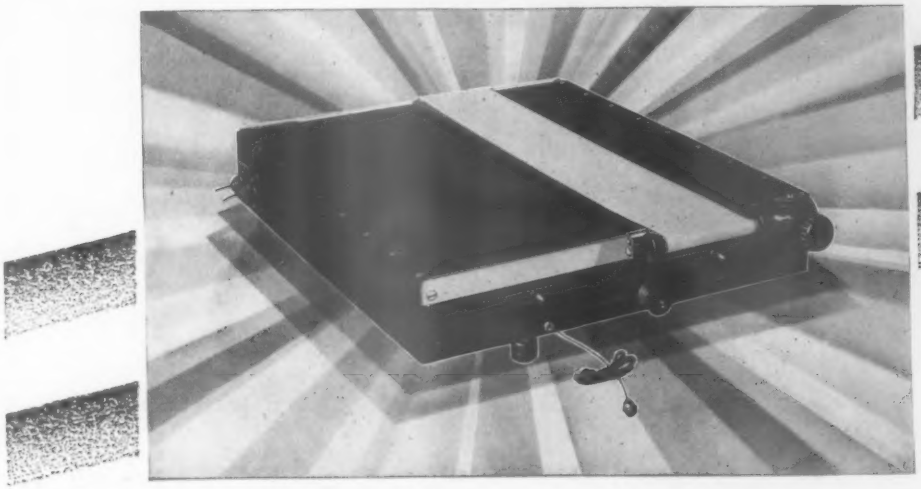

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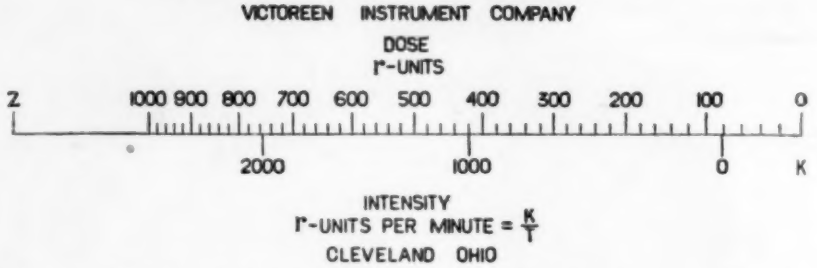

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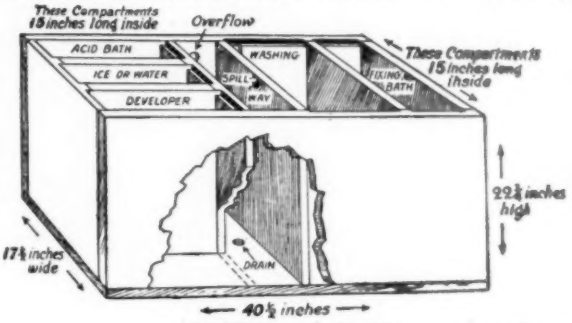

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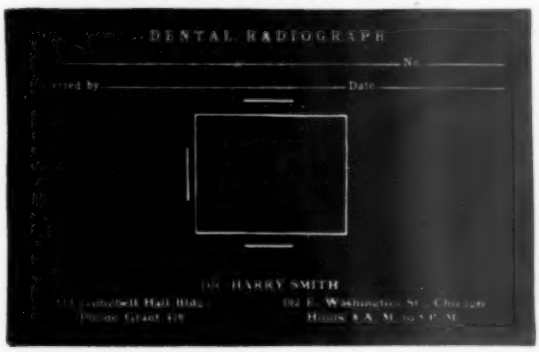

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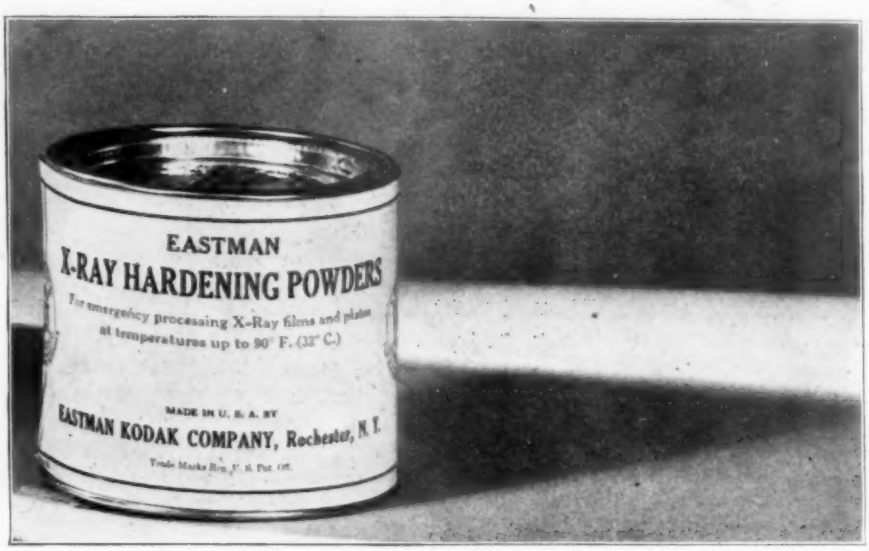
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Harden Your Films in Summer

WHILE it is always preferable to control the temperatures of the developer, fixer and wash water at 65° F. the year around, satisfactory processing can be done at somewhat elevated temperatures if each film is treated in a solution of Eastman X-ray Hardening Powder.

The only effect this solution has on the film is to harden the gelatin coating so that it will not swell excessively, become too soft or reticulate in the warm fixing bath. It will thus protect the films against fixing baths and wash waters up to 90° F.

The Eastman X-ray Hardening Powders are recommended for emergency processing when temperatures cannot be properly controlled, because at higher temperatures the time of development must be shortened and beyond certain limits this impairs detail quality.

Eastman X-ray Hardening Powders are supplied in cans, each sufficient to prepare one gallon of solution. Price $.35 at your medical depot.

Eastman Kodak Company, *Medical Division*
349 State Street, Rochester, N. Y.

Gentlemen:

Please send me your leaflet describing development at elevated temperatures.

Name _____

Street and Number _____

City and State _____